INTERNATIONAL

Journal of Wilderness

In This Issue

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- Constraints to wilderness visitation
- Climate change and wilderness fire
- Germany, Brazil

APRIL 2011 VOLUME 17, NUMBER 1

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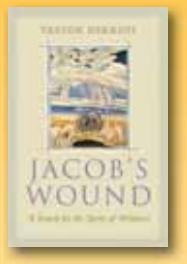

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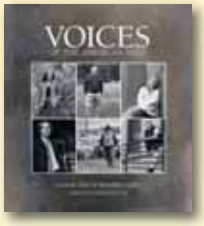

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Journal of Wilderness

APRIL 2011 VOLUME 17, NUMBER 1

FEATURES

EDITORIAL PERSPECTIVES

3 *IJW Transitions into the Future*
BY JOHN C. HENDEE

SOUL OF THE WILDERNESS

4 *Wildlife Scientists and Wilderness Managers Finding Common Ground with Noninvasive and Nonintrusive Sampling of Wildlife*
BY MICHAEL K. SCHWARTZ, PETER B. LANDRES, and DAVID J. PARSONS

STEWARDSHIP

9 *Wilderness Management Exchange Programs The Sharing of Success*
BY GREGORY F. HANSEN

SCIENCE and RESEARCH

14 *Structural Constraints to Wilderness Impacts on Visitation and Experience*
BY INGRID E. SCHNEIDER, SIERRA L. SCHROEDER, and ANN SCHWALLER

22 *Climate Change and Wilderness Fire Regimes*
BY DONALD McKENZIE and JEREMY S. LITTELL

EDUCATION and COMMUNICATION

28 *Youth Conservation Corps Bring Native Youth Back to Wilderness*
BY PAUL DAWSON and VICTORIA HOUSER

INTERNATIONAL PERSPECTIVES

32 *The Green Belt of Germany*
BY TILL MEYER, LIANA GEIDEZIS, and KAI FROBEL

38 *Walking Tracks and Environmental Impact on an Urban Forest Remnant in Rio de Janeiro, Brazil*
BY JOSÉ G. B. DERRAIK and LUIZ ALEXANDRE VALADÃO

WILDERNESS DIGEST

43 *Announcements*

47 *Book Reviews*

47 *Nature's Spectacle: The World's First National Parks and Protected Places*
BY JOHN SHEAIL
Reviewed by John Shultis

47 *Beyond Naturalness: Rethinking Park and Wilderness Stewardship in an Era of Rapid Change*
EDITED BY DAVID COLE and LAURIE YUNG
Reviewed by John Shultis

On the Cover

Main image: Hell's Creek Gorge, running through the small and only remaining remnant of old growth forest within the Bavarian National Park.

Inset: Till Meyer, German eco-journalist [on the Watzlik Hain (Grove) Trail near Hells Creek Gorge] with an old growth fir (*picea abies*), estimated at some 300 years old and 40 meters (130 feet) high.

Images © courtesy of Vance G. Martin/WILD

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—John C. Hendee, *IJW* Editor-in-Chief Emeritus

International Journal of Wilderness

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International Journal of Wilderness (IJW) publishes three issues per year (April, August, and December). *IJW* is a not-for-profit publication.

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Subscription rates (per volume calendar year): Subscription costs are in U.S. dollars only—Online access $35; online access and printed journal $50; online access and printed journal (Canada and Mexico) $62; online access and printed journal (international) $74.
We do not offer an agency discount price. No refunds.

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EDITORIAL PERSPECTIVES

Transitions Into the Future

BY JOHN C. HENDEE

This issue begins *IJW*'s 17th year, embracing a new online availability in our familiar format that was launched with the last issue, free downloadable issues from 1995 to the most recent year's volume, with print copies available at a slightly higher subscription rate (Dawson 2010). Our main goal in providing fingertip availability for *IJW* is to better serve wilderness stewards, scientists, educators, and citizen environmentalists in expanding and improving worldwide wilderness protection. *IJW*'s online future is timely, making it more accessible, and expanding the potential audience with a format appropriate for today's fast pace of communication.

Perusing the *IJW* archive helps document 16 years of important progress in wilderness conservation, much of it on an international front as more countries (21 to date) have recognized wilderness values with some form of protection for their most natural remaining areas. Yet today there is a renewed urgency to further expand worldwide wilderness conservation in the face of growing threats to protected areas even as important justifications for their protection continue to grow. The world's population, soon to top 7 billion people, is impacting natural areas everywhere, and further expanding demands and needs for eco-services such as clean air and water, natural gene pools for medicine and foods, wildlife and fish for nutrition and enjoyment, and "natural experiences" for inspiration, leisure, and ecotourism. Wilderness serves as an ultimate environmental baseline and source for provision of these services, and is, along with other protected areas, the prime tool for mitigating climate change and global warming, since clearing or degrading natural ecosystems, along with burning fossil fuels, are the principal human activities accelerating climate change (Locke and Mackay 2009).

So today, much more than when we started *IJW* 16 years ago, wilderness is being recognized as pro-people, for its key role in the larger quest of keeping the planet livable, providing ecosystem services and supporting a stable climate. A campaign for this larger vision emerged from the 9th World Wilderness Congress and now called Nature Needs Half, "a science and common-sense based conservation vision and campaign that positions nature as a concern of global development and human well-being, with a goal of protecting and interconnecting at least half of the world's land and seas." (Martin 2009, p. 42). *IJW* has a role to play in this campaign, helping wilderness find a reasoned place in "Nature's Half," with information on how to protect the most natural remaining lands and waters.

This work is reflected in the diverse information in this issue of *IJW*: Michael Schwartz and others, identifying a noninvasive and nonintrusive wildlife sampling in wilderness; Gregory Hansen reporting on wilderness management exchange programs sharing success, worldwide; wilderness-related information from Germany (Geidezis et al.) and Brazil (Derraik and Alexandre); impacts on wilderness visitation and experience (Schneider et al.); climate change and wilderness fire regimes (McKenzie and Littell); and bringing Native youth back to wilderness through the Youth Conservation Corps (Dawson and Houser).

In closing, I also announce that after 16 years I am leaving my position as *IJW* editor in chief. My capable colleague Chad Dawson will now be both editor in chief and managing editor. I'll stay in the emeritus wings, retired, but helping occasionally if and when Chad requests. My work with *IJW* has been a great satisfaction, giving me the chance to work with so many fine wilderness colleagues. Although too numerous to mention, I would like to recognize those key colleagues who accepted *IJW* positions 16 years ago to help make it possible, two of whom continue to serve: executive editors Vance Martin, president of The WILD Foundation, also *IJW* controller; Alan Watson, Forest Service research; Alan Ewert, then with the University of Northern British Columbia; Dave Porter, Bureau of

Continued on page 21

SOUL OF THE WILDERNESS

Wildlife Scientists and Wilderness Managers Finding Common Ground with Noninvasive and Nonintrusive Sampling of Wildlife

BY MICHAEL K. SCHWARTZ, PETER B. LANDRES, DAVID J. PARSONS

Iconic wildlife species such as grizzly bears, wolves, lynx, and wolverines are often associated with wilderness. Wilderness may provide some of the last, and best, remaining places for such species because wilderness can offer long-term legislated protection, relatively large areas, and remoteness (Mattson 1997). Indeed, the word *wilderness* in its original form literally means "place of wild beasts" (Nash 1982). Despite this natural fit between wilderness and wildlife, simply drawing a boundary around an area such as wilderness does not assure the protection and persistence of wildlife either inside the area or across the broader landscape (Landres et al. 1998). Only by understanding where such species occur and how their populations are faring can we know if wilderness is aiding in the role of sustaining wildlife.

Traditionally, wildlife scientists have used tools such as collecting individuals, trapping, and equipping animals with radio collars to understand the distribution, movement patterns, behavior, and abundance of wildlife. These tools, however, may pose a significant problem to wilderness managers because the primary legal mandate in wilderness is preserving wilderness character (Rohlf and Honnold 1988; Scott 2002), and such tools may degrade wilderness character (Landres et al. 2008). For example, we can ask how the perception of natural or untrammeled may be impacted when a visitor to the wilderness sees wildlife wearing a radio collar or tag. Similarly, how does the temporary placement of weather gauges or telemetry stations influence the undeveloped aspect of wilderness? Examples such as these have led to an understandable tension between wildlife scientists and wilderness managers: scientists strive to maximize sample sizes and data quality while minimizing field costs, and managers strive to uphold legal regulations by only allowing research that is necessary to preserve wilderness character and ensure that such work uses only the minimum methods, approaches, and tools (Hendee and Mattson 2002).

This tension between scientists desiring to work in wilderness and managers striving to preserve wilderness character has been a concern for decades. Franklin (1987), Parsons and Graber (1991), Oelfke et al. (2000), and others have explored the concerns and debates about using invasive research tools to understand the dynamics of wildlife populations. However, this philosophical debate extends beyond the conflicting goals of each party. It broadens to the question of permitting activities that may degrade wilderness character in the short term, yet enhance it by providing critical data over the long term. Indeed, there is a paradox that has historically arisen in which wilderness managers are in the position of balancing the preservation of wilderness character while still permitting the science that can either inform or lead to improvements of the very wilderness character they are fostering.

This article discusses relatively new wildlife biology research tools that may help ameliorate this debate. In nearly

all scientific disciplines, technological advances are providing a new suite of research tools that can bridge the gap between wildlife researchers and wilderness managers, and reconcile the manager's dilemma of short-term versus long-term preservation of wilderness character. In this article we discuss how the fields of molecular ecology, endocrine biology, and stable isotope analysis can provide high quality data through the use of noninvasively and nonintrusively collected samples. Although these tools are not a panacea to the tensions described above, they are at least an option that can lead to improved communication between managers and scientists. Furthermore, these tools can minimize impacts to wilderness character while providing the information needed to understand the dynamics of wildlife populations and the conditions needed to sustain them.

Noninvasive versus Nonintrusive Sampling

The trend in wildlife science has been to move away from lethal and highly intrusive methods that were commonly used in the mid-19th century, and still prevalent throughout the 20th century. Early scientific expeditions often relied on lethal collecting of specimens. For instance, between 1914 and 1920, Joseph Grinnell, the famed natural historian at the University of California at Berkeley, collected more than 4,000 specimens from a wide variety of species in Yosemite National Park (Moritz et al. 2008). Although this lethal sampling has proven to be enormously useful for answering a variety of modern-day questions (Moritz et al. 2008), it can be argued that nonlethal methods that are available today may offer comparable data. Even some of the most common methods used by today's wildlife ecologists, such as radio and satellite telemetry or "marking" individual animals to understand animal movements, survival, and habitat use, are being questioned on both ethical and data-quality grounds. This is because capturing and handling individuals has been shown to reduce survival and may ultimately reduce the individual's lifetime fitness (Marco et al. 2006; Cattet et al. 2008; McCarthy and Parris 2008). Although these invasive approaches are not casually used by researchers, less invasive approaches have often been sought or at least considered prior to initiation of a project.

Recently, the field of molecular ecology has been leading the way in noninvasive sampling. In molecular ecology, the term *noninvasive sampling* is the collection of samples for genetic analysis where direct contact (physical or even visual) between researchers and animals is avoided (Taberlet et al. 1997; Schwartz et al. 1999). In recent years, noninvasive genetic sampling has produced important data on the population structure, abundance, diet, and genetic connectivity among populations of many elusive species, some that would otherwise be virtually impossible to study (Bergl and Vigilant 2007; Marucco et al. 2009; Valentini et al. 2009).

However, not all noninvasive genetic sampling is nonintrusive. That is, many times noninvasive sampling involves drawing an animal to a device using an attractant or lure, and subsequently inducing the animal to interact with a collection device, such as a piece of double-sided sticky tape or barbed wire (Zielinski et al. 2006; Kendall and McKelvey 2008). Although these methods are noninvasive, they are not nonintrusive.

Here we introduce the term *nonintrusive sampling*. By nonintrusive sampling we mean scientific methods that are used to learn about an animal without perceived manipulation of the behavior of the animal. For instance, in some research circumstances we can track an animal on natural surfaces to find hair or feces (McKelvey et al. 2006; Heinemeyer et al. 2008) or use detector dogs (MacKay et al. 2008) to find feces of a target species that can be used to obtain key genetic material. These approaches offer significant scientific benefits because there is limited observer effect (i.e., the animal is not being drawn to a device), thus allowing inferences about habitat preferences without the scientist influencing the result. In addition, these nonintrusive sampling methods will lower the potential impact on wilderness character.

With this concept, we now have a continuum or gradient of intrusiveness

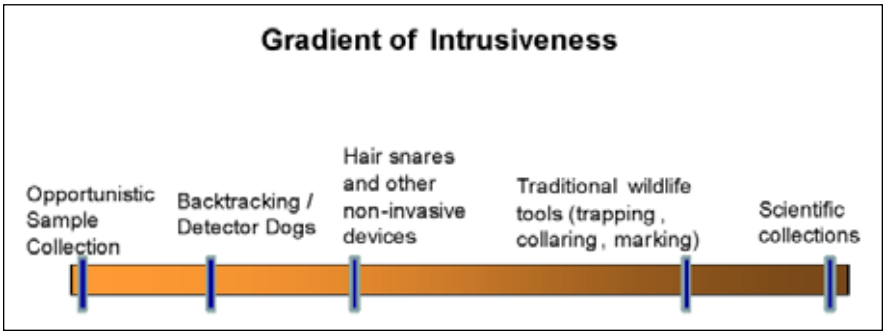

Figure 1—This graphic illustrates a gradient of "intrusiveness" of tools and techniques used by wildlife biologists to collect data. On one end of the spectrum are opportunistic samples collected by field biologists where there is little suspected impact on the individual or population by collecting the sample. On the other end of the spectrum are scientific collections, where lethal means are used to collect samples. This does not imply that data quality is equal across the spectrum, but does suggest that a range of tools that should be evaluated does exist.

for all research approaches (see figure 1), with lethal collection anchoring one side and nonintrusive genetic sampling anchoring the other. Noninvasive genetic sampling would be positioned near the nonintrusive side of the gradient. Techniques such as adding a hair collection device at sites naturally visited by animals, as is being implemented with grizzly bear studies (Kendall et al. 2009), would fall amid noninvasive and nonintrusive sampling (see figure 1). Establishing this framework should facilitate communication between scientists and wilderness managers, and provide new options for studying difficult, rare, and elusive animals in wilderness.

Noninvasive and Nonintrusive Sampling Sometimes Provides Better Data

Historically there has been a trade-off between the level of intrusiveness required and the quality of the data generated (see figure 2). Grinnell and colleagues did not have many options to learn about California wildlife with less invasive methods and thus used lethal methods. Even in the era of radiotelemetry there were few reliable, noninvasive alternatives to the radio collar available for researchers to learn about the secretive nature of their study species. In some cases, scientific and technological advances have now eliminated this trade-off (see figure 2). For example, a recent study by Kendall et al. (2009) collected 20,785 hair samples using hair snares and natural bear rubs to estimate the population of grizzly bears in the Northern Continental Divide Ecosystem. This 31,410 km^2 (12,127 $mile^{2)}$ study area included the Bob Marshall, Great Bear, Scapegoat, Mission Mountains, and Rattlesnake Wildernesses in Montana. As a result, the authors were able to estimate that 765 bears (with a 95% confidence interval of 715–831 bears) reside in this area, more than initially predicted by managers (Kendall et al. 2009). If these scientists relied on traditional capture-mark-recapture approaches, they would never have been able to produce such a precise population abundance estimate. Here, advances in the field of molecular genetics and noninvasive genetic sampling allowed data quality to *increase* while intrusiveness actually *decreased*. The combination of noninvasive (hair snares) and nonintrusive (natural bear rubs) approaches provided wilderness managers and wildlife scientists a better answer than if traditional sampling approaches were used—a win-win situation.

Other Technological Advances Reduce Intrusiveness: A Wolverine Case Study

Molecular genetics isn't the only field to provide technological advances that reduces intrusiveness. A recent example of a wolverine appearing in California, where the last confirmed animal was documented in 1922, highlights how advances in molecular genetics, remote-camera operation, and stable-isotope analysis can provide answers without invasive methods (Moriarty et al. 2009). In February 2008, a graduate student was working on a marten project in the Sierra Nevada, California. One of her remote camera sets captured a picture of a wolverine. For years, there have been reports of visual observations of wolverines in California, but no supportive evidence. In fact, many noninvasively collected hair and fecal samples have turned out to be from other species such as marmots and bears. This photograph was the first definitive evidence of this species since Joseph Grinnell's era. But this photograph didn't answer other important questions: How did the wolverine get there? Was it from a population that persisted in California undetected for decades? Did it migrate from one of several neighboring populations in the Rocky Mountains or the North Cascades of Washington?

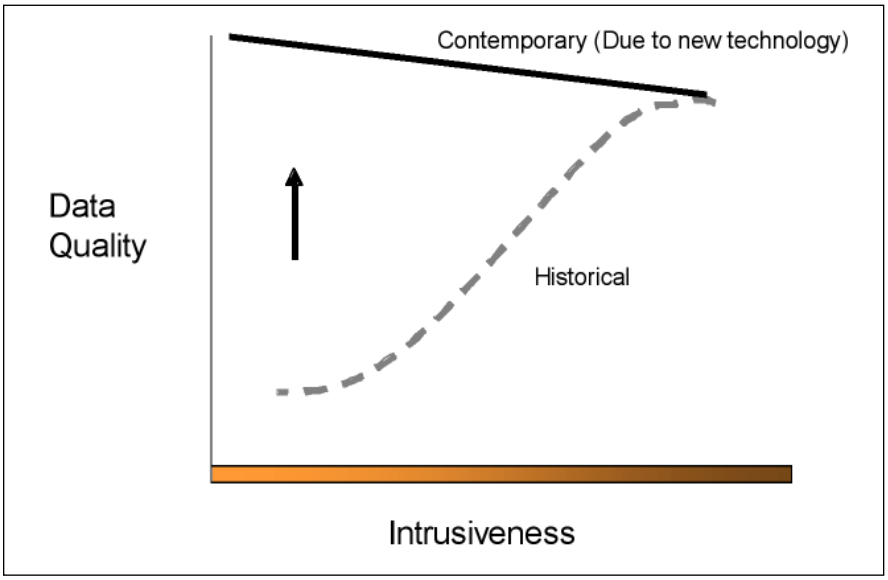

Figure 2—A schematic comparing the level of intrusiveness of a wildlife technique versus data quality. Historically, there was a positive relationship between how intrusive a wildlife biology technique was and the quality of the data obtained (dotted line). Currently, in some cases, data quality can be higher with less intrusive methods due to newer technologies (solid, black line).

Researchers used a combination of baited hair stations (16 stations covering 150 km^2/58 sq. miles), detector dogs (searching over 100 linear km/62 mile), and biologists looking for samples deposited over the snow tracks of the animal to collect 82 noninvasive or nonintrusive fecal and hair samples. Six of these samples positively identified the animal as a wolverine through molecular genetic analyses. Subsequent analysis revealed that this individual initially came from a population in the western portion of the wolverine's geographic range in the Rocky Mountains of Idaho (Moriarty et al. 2009). Most important, using ancient DNA techniques and pieces of historical California wolverine skulls from museums, Schwartz et al. (2007) determined that this individual did not match DNA samples obtained from the California population that persisted in the region in the late 19th and early 20th centuries. Given these data, it is highly unlikely this animal persisted in the California wilderness, undetected for more than 80 years. Stable isotope analysis using carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) confirmed these results. Specifically, two noninvasive hair samples from this California wolverine were compared to reference hair samples from other geographic areas, confirming that this unknown animal came from the Rocky Mountains (Moriarty et al. 2009). Overall, the multiple noninvasive and nonintrusive sampling (camera sets, detector dogs searching for scat, molecular genetic analyses, and stable isotope analyses) allowed us to make inferences that would be unobtainable using traditional approaches. DNA analyses on the hair and fecal samples also determined that the animal was a male, which is the sex that is known for its dispersal capability. Additional endocrine work was not undertaken, but could have been conducted from the fecal samples to evaluate stress and physical condition (Schwartz and Monfort 2008).

. . . wilderness managers needed to balance short-term disruptions to wilderness character with long-term information gains that may preserve or enhance wilderness character.

Conclusions

Historically, a high level of invasiveness and intrusiveness was required to obtain useful data for understanding and ultimately managing wildlife. In wilderness, these methods may lead to conflicts between wildlife researchers and wilderness managers who are respectively trying to maximize data quality and preserve wilderness character. Additionally, wilderness managers needed to balance short-term disruptions to wilderness character with long-term information gains that may preserve or enhance wilderness character. Recent developments in the wildlife sciences provide less invasive and less intrusive approaches that obtain data of equal or higher quality than acquired using traditional approaches. In some situations these newer approaches may be insufficient to understand the distribution and population dynamics of a species, and traditional approaches may still be needed. But in many other situations these newer methods have shown that they can provide better quality and quantity of data to understand the dynamics of wildlife populations with less impact to wilderness character. These new methods should foster better and more informed communication between wilderness managers and wildlife scientists to further their mutual interests in sustaining wildlife and preserving wilderness character.

Acknowledgments

This work comes from discussions held at the George Wright Society Conference in Portland Oregon (2009). Michael Schwartz was supported by a Presidential Early Career Award for Science and Engineering while working on this project. We thank Katie Moriarty for reviewing an early draft of this manuscript.

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Wilderness Management Exchange Programs

The Sharing of Success

BY GREGORY F. HANSEN

Introduction

The information provided in this article is a direct result of field-tested local, regional, national, and international wilderness exchange efforts (Densham and Cooper 2001; Van Den Berg and Swain 2007) and experience by the author through the USDA Forest Service's Superstition Wilderness Management Program (Hansen 1988). Outlined below are program frameworks and exchange strategies, as well as information pertaining to the planning and realization of successful wilderness and trails management exchange activities. Please note that although the content of this article focuses primarily upon the exchange of wilderness-managing-agency-seasonal (temporary/part-time) wilderness personnel, many of the strategies provided below have been successfully utilized to exchange permanent full-time employees, as well as nongovernmental wilderness-supporting organization workers and students.

What Is a Wilderness Exchange Program?

A wilderness exchange program is the sharing of ideas, information, management strategies, and/or personnel between two different wilderness-managing entities. Exchange programs can be conducted between public land management agencies, among wilderness-supporting organizations and/or educational institutions, or any mix of these scenarios. Therefore, be creative with the exchange concept, and positive end results are most likely to follow.

Why Use Exchange Programs?

Wilderness managers throughout the National Wilderness Preservation System, and around the globe, face the realistic dilemmas of inadequate funding and staffing. A well-planned and carefully managed exchange program can result in significant short- and long-term management improvements by sharing successful program strategies, information, training and personnel, and can help managers keep their wilderness crews in the field longer. Quality exchange efforts can also serve to enhance working conditions for the dutiful seasonal wilderness employees who, in many cases, have selflessly dedicated their entire careers toward the betterment of wildlands.

Therefore, when inconsistent budgeting or limited full-time employment slots do not allow for the hiring of permanent wilderness employees, consider developing a wilderness exchange program that will present seasonal employees with other forms of support, such as extended work seasons, minimal health benefits, diverse cross-training opportunities, and pay scales comparable to those in other management functions. Thus, wilderness managers are able to maintain, and improve, their overall level of management by keeping their most experienced wilderness workers in the field for longer periods of time, while simultaneously offering these talented temporary wilderness stewards the career opportunities and overall support they so deserve.

Exchange Benefits

There are many different types of wilderness and trail management exchange opportunities available to managers, and all can be rewarding as well as beneficial. An example of a worthwhile exchange would be the transfer of an experienced trail crew that works primarily in the summer months in a high-elevation wilderness unit to another wilderness area that runs its program in lower elevations during the cooler months.

Another illustration of wilderness employee exchange is sharing a national park game guard between two separate parks that host different high-use seasons. Both of these exchange examples generate payoffs for the units involved,

for the employees themselves by extending their work season, and of course will help to improve the resource via more staffing.

Exchange programs can substantially benefit the wilderness resource, as well as participating management units. Advantages include, but certainly are not limited to:

- Information and technical expertise transfer
- Improved internal agency relations between wilderness and nonwilderness departments
- Improved agency-to-agency relations
- Establishment of a more stable work environment for temporary employees who return year after year
- Minimization of lump sum leave payments and unemployment compensation
- Development of career ladders
- Burn-out prevention, by offering seasonal employees work in other departments
- Enhanced cross-training opportunities

Intra-agency Personnel and Information Exchange

Intra-agency, or more localized exchanges of information and personnel, can be conducted within a national forest or Bureau of Land Management (BLM) resource area, or, for example, within a provincial park or game reserve. Such transferences of wilderness rangers, recreation planners, trail crew supervisors, trail crews, education specialists, and temporary wilderness managers can also be implemented at the next organizational layer such as between geographically adjoining national forests, statewide BLM units, and/or international game parks and reserves.

The same type of employee trade is possible within national parks or wildlife parks and refuges where certain expertise is needed full-time in one park or refuge, but is only necessary on a case-by-case basis in another. Time frames for local exchanges can range from a single day or an entire work season, to multiple-year endeavors. Intra-agency exchanges are usually the easiest to coordinate as, it is hoped, working relations and open communication have already been established between participating agencies/management units.

Internal Unit Cross-functional Exchange and Training

Although wilderness planning and management requires year-round commitment, many areas frankly do not or simply cannot, commit the dollars needed to keep employees working solely in wilderness all year. Cross-functional exchanges that are conducted within the organizational structure of a district or management area can be developed between wilderness and nonwilderness management functions such as fire or developed recreation.

For example, a cross-functional exchange could be achieved by working temporary employees in developed recreation (campground- and facility-based recreation) in the winter, and then in wilderness in the warmer summer and fall months. Internationally, this form of cross-functional exchange would of course need to be carried out in accordance with each manager's respective wilderness management issues and applicable seasonal weather patterns.

These types of cross-functional exchanges offer temporary wilderness employees an option to work the off-season in other departments, which hosts myriad short- and long-term payoffs. For example, cross-functional exchange endeavors not only can help to broaden a temporary employee's experience base, making them more marketable and better prepared to compete for full-time positions, but can also help them better understand the important nonrecreational elements of wilderness. This approach can also be an integral step toward improving working relations between nonwilderness departments by placing competent wilderness employees in other management sections where they are able to share the purposes for protecting and managing wilderness.

Once a cross-functional program has been established and funding has been maintained over an extended period of time, justification exists for creating full-time appointments for the seasonal employees, who have been working throughout the year in the two separate resource disciplines. Undoubtedly, cross-function exchanges take time and effort to build. However, with commitment and effective coordination, the benefits can be numerous, and to reiterate, can foster improved working relations between wilderness and other departments, can help to retain experienced wilderness personnel, will provide temporary wilderness employees with a higher level of job security, and will make temporary employees more marketable for jobs in other resource management disciplines.

Statewide/Provincial and Regional Personnel and Information Exchange

Statewide (provincial) or regional exchange efforts could include the sharing of temporary personnel, or term employees (positions that are hired for a designated period of time such as one year), throughout geographic regions or states. A good example of this type of exchange endeavor is how a wilderness unit in a warm climate, such as the desert southwestern United States, hosts a wilderness ranger in the winter, and then that employee is

transferred north to work in a higher-elevation unit during the spring and summer months.

Organizing a provincial- or regional-level personnel transfer may seem overwhelming, but the author has been successful at contacting the supervisor of the seasonal employee, who is already working between two wilderness managing units, to begin the conversation of workforce exchange. Once this initial conversation is open and all parties involved are in agreement, the details of the employee trade can be initiated and sorted out. Of course, it is crucial to follow the proper chain-of-command protocol, and it is imperative to keep all supervisors and overhead continually informed throughout the entire exchange process.

Exchanges of this kind can foster quality information sharing, which ultimately can help to establish a more consistent management approach throughout a specific geographical area. This type of personnel transfer can also help to keep temporary and term employees working, reduces the amount of time and money spent retraining folks year after year, and can serve to reduce the amount of funding paid out to unemployment insurance and other costs associated with hiring and laying-off temporary employees.

Zone-wilderness Management Exchange Strategy

A zone-style management approach can be used in areas where a number of small- and medium-sized wilderness units are managed by more than one office or agency. Recruiting, developing, and maintaining a zone wilderness and/or trail crew can greatly minimize costs to any one specific wilderness-managing unit. For example, a BLM district that is charged with managing 10 separate wilderness areas could organize a six-person Wilderness Ranger Corps (WRC) that is divided into three teams of two rangers each.

Each team would be assigned management responsibilities according to access and travel time from their respective workstations to the wilderness where they are assigned, and according to management issues and related technical skills. All WRC teams would be assigned everyday wilderness management duties for the primary wilderness units they were responsible for, such as sign and trail maintenance, campsite restoration, resource monitoring, and public contact and education. But, when a large-scale project is planned for one specific wilderness unit, the entire team could be summoned to work on that particular project, returning afterward to their regularly assigned areas upon completion or when deemed necessary, such as on busy weekends when visitor contact and education are required.

Interagency Personnel and Information Exchange

Interagency exchange programs are a productive means of sharing knowledge and can be effective in reaching across agency barriers to manage wilderness in a consistent and professional manner. For instance, an experienced trail crew from one agency could be contracted in their off-season to accomplish a small but important trail reconstruction project for the receiving agency that only needs that type of trail repair work done every few years. During the project, the host agency can place local employees with the experienced crew to provide guidance on local specifications and issues, and in return, the host agency simultaneously receives valuable trails management training and successfully completes a priority work project.

Benefits of an interagency-style exchange are:

- The host unit does not have to recruit or train a large full-time crew
- The host agency does not have to spend more money than is necessary to complete small projects that are only required every so often
- The host agency learns about trail management from qualified trail specialists, and the experienced trail crew is offered the opportunity to extend their normal work season.

An example of an interagency exchange would be a wilderness unit that brings in an experienced individual or team from another agency to help develop and implement a Limits of Acceptable Change (LAC) social and/or biological inventory and monitoring system. The consulting detailer is charged with identifying what type of monitoring program is needed and then assists the receiving manager in developing an LAC implementation plan that is designed for his or her specific needs. The consulting expert can be on call to help train employees who will be conducting the actual monitoring and could be contacted at any time the program is being instigated to answer questions and advise the receiving manager. Cross-agency information transfer can greatly increase communications between agencies and at the end of the day can foster a positive atmosphere for consistent wilderness management across agency boundaries, while reducing training and program development and evaluation costs.

International Personnel and Information Exchange

International personnel exchanges can be extremely rewarding and beneficial, but most certainly take a great deal of

time and effort to plan, coordinate, and carry out. In this author's experience, a great deal of pre-exchange planning and communication is required before any actual physical exchange of personnel ever takes place. Tasks such as on-site scheduling, obtaining passports, and making vaccination appointments all take extensive preplanning, and must be given ample time to accomplish.

International exchanges can be carried out with temporary employees, but most areas prefer to send full-time, or long-tenured temporary employees they know will return year after year, to ensure that the information gained from the exchange is carefully secured and shared over time through practical application.

International exchanges in many instances begin by sending or receiving participants "one way," and not actually exchanging folks from one country to another. However, over time, as the partnership develops it is possible to discuss sending exchange employees back and forth. Unfortunately, many wilderness or natural resource management programs outside the United States do not always have the funds to send their employees to the States, and therefore grant and/or scholarship programs must be sought out to fund their participation.

When conducting international exchanges, make a strong effort to invite two guests whenever possible, as this allows transfer participants to be more comfortable and safe while traveling abroad. This will help to ensure a more relaxed working atmosphere, as the international traveler is not completely isolated and alone in a strange land and working environment. Furthermore, carefully consider prospective issues such as language and terminology barriers to ensure appropriate communication can be made.

Similar to the exchange endeavors described above, information collected and accumulated through international personnel exchange must be accurately documented and utilized. Some international exchange programs may require weekly or monthly reporting to ensure that valuable knowledge is not lost, whereas others may only ask for an exchange participator to develop a report at the end of their experience.

Quality exchanges can be extremely advantageous and…can be instrumental in enhancing current wilderness resource conditions and user experiences by providing more highly skilled and qualified staff out on the ground for longer periods of time.

International exchange can be one of the most rewarding ventures a manager will ever participate in; in many instances lasting friendships can evolve that reach far beyond the original intent of the initial personnel transfer. International information exchange can be accomplished much more easily than person-to-person transferences, and it can be done fairly easily via email communications, over the telephone, and through credible written mediums such as the *IJW*.

Tips for Developing a Successful Exchange Program

The following information is useful when developing any of the exchange programs outlined above:

- Allow plenty of lead time when beginning any type of exchange, especially if the program extends over agency boundaries, states, regions, or countries—one full year being a realistic advance planning time frame.
- Carefully target the desired exchange audience so the transfer of personnel or information specifically meets the receiving manager's program goals.
- If exchange contacts are not already in place, develop and disseminate hard copy and/or electronic announcement flyers that advertise exchange opportunities.
- Exchange outreach announcements should be concise but must include a brief description of the program, pay scales, exchange time frames, and housing arrangements—similar to full-time job announcements.
- Formally begin the exchange process by sending a detailed letter, signed by the highest authorizing officer possible, to the exchange units, explaining program expectations, funding, and desired outcomes.
- Once the exchange has been confirmed, provide participants with a preprogram information packet.
- Preprogram packets should include a complete job description; tentative work schedule; maps and recreation opportunity guides; information on local geology, flora, and fauna; and a detailed what-to-expect/what-to-bring list.
- A history of the wilderness they will be working in and a summary of that area's issues is also helpful in a preprogram packet, but most important, include a detailed outline that clearly defines the overall expectations of the exchange participant.
- Work closely with budget and personnel specialists in the early planning stages of the exchange in order to reduce miscommunications as the exchange materializes.

- Make a strong effort to effectively communicate with and support exchange participants and their supervisors throughout the entire process.
- Always monitor, evaluate, and report exchange-program accomplishments and successes, and be sure to include upper-level decision makers—using the proper chain of command, of course, in the reporting process.
- Always monitor, evaluate and report exchange program accomplishments and successes, and be sure to include upper-level decision makers—using the proper chain-of-command of course, in the reporting process.
- The Society for Wilderness Stewardship (SWS) is working to launch a "Wilderness Mentor Program" that would connect up-and-coming managers and rangers with experienced wilderness experts to provide career mentoring and wildland management issue-driven counsel. Please watch for this new service on the SWS website: www.wildernessstewardship.org .

Summary

With the realities of inconsistent budgeting and the continual reduction of the wilderness workforce, it is crucial that managers benefit from the sharing of success through creative programs such as the efficient exchange of quality personnel and ideas at all levels of their agencies and/or organizations. Will employee and information transfer take time, effort, and funding? Of course it will. Will agencywide and interagency exchanges take commitment and creativity to achieve? Absolutely! However, quality exchanges can be extremely advantageous and, if developed and managed properly, can be instrumental in enhancing current wilderness resource conditions and user experiences by providing more highly skilled and qualified staff out on the ground for longer periods of time.

Furthermore, managers need not shoulder the responsibility of reinventing the wheel, as successful exchange programs currently exist. Take advantage of proven exchange endeavors that have already achieved positive results (see program contact information below) and adjust field-tested models into a program that meets each manager's specific needs (see table 1). Whenever and wherever possible, reward talented seasonal wilderness leaders with full-time appointments, and at the least, offer them the advantages of taking part in a well-organized exchange program. Because it is with their skills and unyielding dedication that the future of wilderness truly lies…a deep-rooted wisdom that must be enshrined indefinitely and passed on to future generations…for the life-sustaining benefits of wilderness!

Table 1—Wilderness Exchange Program Contacts

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Structural Constraints to Wilderness

Impacts on Visitation and Experience

BY INGRID E. SCHNEIDER, SIERRA L. SCHROEDER, and ANN SCHWALLER

Abstract: A significant research body on recreation constraints exists, but wilderness constraints research is limited. Like other recreationists, wilderness visitors likely experience a number of constraints, factors that limit leisure preference formation or participation and enjoyment. This project explored how visitors' experiences with and in wilderness are constrained, and examined responses to those constraints. A hermeneutic approach (Patterson and Williams 2002) provided the stories of wilderness visitors' experiences and constraints to experiences with and in wilderness. A purposive sample identified respondents for in-depth face-to-face interviews with a semistructured interview guide. Interviews were transcribed verbatim, and analysis considered visitors' individual stories and stories across individuals. Member checking and dual readers provided discussion opportunities about and validation of the interpretations. Similar to other types of recreation, a variety of constraints to wilderness visitation emerged, although structural constraints dominated the conversations. Of particular interest to wilderness managers are the visitors' coping responses to constraints: shortened trips with fewer miles traveled influence both social and biophysical management areas. Future research opportunities include monitoring longer-term impacts on experiences, visitor use patterns, and subsequent biophysical impacts.

Introduction

Constraints are "factors that are assumed by researchers and/or perceived or experienced by individuals to limit the formation of leisure preferences and/or to inhibit or prohibit participation and enjoyment in leisure" (Jackson 2000, p. 62). Since inception, recreation constraints research has resulted in substantial insight as to what constraints exist (Jackson 2005; Mowen, Payne, and Scott 2005; Green, Bowker, Johnson, et al. 2007), how constraints can be modeled (Jackson 2005; Walker and Virden 2005; Schneider and Stanis Wilhelm 2007), and how constraints are negotiated or accommodated (Jackson, Crawford, and Godbey 1993; Samdahl and Jekubovich 1997; Walker and Virden 2005; Schneider and Stanis Wilhelm 2007). However, wilderness constraints research is quite limited.

A brief review of constraints research reveals that structural constraints were initially hypothesized to intervene between leisure preference and participation, intrapersonal constraints were psychological attributes that interacted with preferences, and interpersonal constraints seemingly arose out of interactions with others. In the evolution of constraints models since the 1990s (Crawford, Jackson, and Godbey 1991; Jackson et al. 1993; Walker and Virden 2005; Schneider and Stanis Wilhelm 2007), a complex and comprehensive model is currently under consideration. The model includes individual and situational factors that influence appraisal and response processes to constraints and recognizes these simultaneously occurring constraints can be accommodated or negotiated (Schneider and Stanis Wilhelm; Walker 2007). A variety of coping mechanisms are frequently used in response to constraints, typically

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classified as problem-focused or emotion-focused. Problem-focused coping include direct actions, planning, and active responses, whereas emotion-focused approaches are indirect and include distancing and controlling emotions (Iwasaki and Schneider, 2003).

Despite the progress in constraints research made more broadly within the field of leisure, wilderness-specific constraints research is limited. In the published literature, a single study examines constraints to wilderness recreation participation (Green et al. 2007). Green et al. compared various factors or constraints to wilderness visitation among a national sample. Findings indicated that minorities, women, those with lower levels of income and education, and elderly populations were more likely to perceive constraints. Notably, these were constraints to visitation only. Although participation constraints are important, they are just one step to a fuller comprehension of wilderness recreation constraints.

Recognizing that the paucity of constraint research impedes effective management and high quality visitor experiences, researchers have called for additional investigations of wilderness recreation constraints (Green et al. 2007; Schneider 2007; Johnson and Dawson 2004) and details of constrained experiences (Cole 2007). In response to these calls and in an effort to expand the knowledge base on wilderness constraints, this project explored structural, intrapersonal, and interpersonal constraints to wilderness visitation and subsequent impacts on visitor behavior and experiences. Within the scope of this report, structural constraints and resultant impacts were considered. Specifically, this project addressed these research questions: if and how Boundary Waters Canoe Area Wilderness (BWCAW) visitors' experiences are constrained and how visitor behavior and wilderness experiences have been influenced by those constraints. Constraints to wilderness visitation were documented quantitatively by Green et al. (2007); the qualitative findings from this study add depth and additional meaning to the existing constraints literature.

Methods

A qualitative approach explored the depth and breadth of the BWCAW visitor perspectives and lived experiences and, in this article, we report on constraints. This study was guided by the assumption that rich meaning can be found by exploring how people remember, construct, and make sense of their experiences. The study was designed using a hermeneutic approach and in-depth face-to-face interviews with participants (Patterson and Williams 2002).

Sampling

The sample was obtained using a network, or snowball sampling, technique to capture a broad range of BWCAW visitors and visitation histories. A purposive sample was used; a sampling method that reflects the diversity of a group and seeks to include any "outliers" that perhaps would be discounted in a statistical study (Barbour 2001). To obtain the sample, an email request was circulated to known BWCAW visitors that asked them and those they knew to complete a screening online survey. Complementing this approach, fliers soliciting BWCAW visitors to participate were posted at outdoor equipment stores in the Minneapolis–St. Paul, Minnesota, metropolitan area.

As a result, 98 potential participants completed an online questionnaire that assessed BWCAW visitation history and experience (see figure 1). Specifically, the online assessment asked questions related to the year of first and most recent BWCAW visit, BWCAW attachment, and experience use history. Then, respondent data were separated into high, medium, and low experiences with the BWCAW based on a combination of those questions. All those who completed the questionnaire and indicated they were interested in an interview for $20 compensation, and those who were in either the high or low experience ends of the continuum (one standard deviation above and one standard deviation below the median) were invited to participate in an interview (n = 34). This sampling protocol increased the likelihood of obtaining rich and unique stories (Laverty 2003) reflecting how constraints and varying coping mechanisms influence the visitors' behavior and experience over time.

The sample size was determined by data saturation, the point at which no new information or themes were observed in the data. The literature has suggested a range of numbers to reach data saturation; Bertaux (1981) claims

Figure 1—Resting at a campsite in the BWCAW. Photo courtesy of Sierra L. Schroeder.

that a minimum of 15 interviews are needed for any qualitative study, whereas Guest, Bunce, and Johnson (2006) posit that data saturation can occur with 12 interviews. Data saturation was achieved with 25 interviews in this study, including 9 interviews with BWCAW visitors with low-experience areas and 16 interviews with high-experience respondents. Interviewees are identified by a fictitious name in this article to guarantee anonymity.

Study Setting

The Boundary Waters Canoe Area Wilderness is a unique area containing more than 1,200 miles (1,931 km) of canoe routes, nearly 2,200 designated campsites, and more than 1,000 lakes and streams. The BWCAW covers approximately 1.1 million acres (0.45 million ha), extending nearly 150 miles (241 km) along the International Boundary adjacent to Canada with Voyageurs National Park bordering on the west (USDA Forest Service 2009). Situated in the northern third of the Superior National Forest in northern Minnesota, the BWCAW (see figure 2) is one of the most visited wilderness areas in the United States and hosts more than 250,000 visitors annually; approximately 57% are from the state of Minnesota (USDA Forest Service 2006).

The interviews took place in relaxed and convenient environments selected by the participants, such as a cafeteria or library, in and around the Minneapolis–St. Paul metropolitan area. The interviews were conducted in these informal settings as "directed conversations" (Charmaz 1990), employing open-ended questions to allow each interview to take shape as directed by the unique conversation (Wolcott 2008). A semistructured interview guide with multiple probes encouraged freedom in response but kept the conservation generally focused on the research questions of interest (Kvale and Brinkmann 2008). The interviews lasted anywhere from approximately 20 minutes to almost two hours, and each interview was digitally recorded and transcribed verbatim. The data set used for analysis consisted of both the audio recordings and the transcriptions. Interviews took place between November 2008 and May 2009.

Analysis

Interview analysis consisted of multiple and thorough readings of each transcript by dual readers, ordering the data according to categories and coding by themes. Initially, the transcripts were individually analyzed to identify the major categories and elements of each participant's story and experience. The coding process that followed consisted of identifying similar themes across cases and grouping them under a representative name. The data were coded using the qualitative analysis software NVivo (QSR International Pty Ltd 2002).

In this study, participants commented individually via email on the accuracy of the idiographic interpretation of the individual's story and experience. This member checking is the process through which participants review and validate the interpretations and the findings presented by the researcher (Creswell and Miller 2000), and is "the most crucial technique for establishing credibility" (Lincoln and Guba 1985, p. 314).

Results

Twenty-five BWCAW visitors, 13 males and 12 females, shared stories revealing recreation constraints. Similar to other types of recreation, a variety of constraints to wilderness visitation and experience emerged: we focus on structural constraints in this article due to their prevalence. Further, and supporting current constraints approaches, constraints were not constant but rather dynamic and changed through time, depending on an individual's life stage, and were influenced by a variety of factors. The study results are organized into two sections to address the research questions: (1) if and how visitation and experiences were constrained, and (2) the impacts of these constraints on visitor behavior and the wilderness experience.

Constrained Experiences

Individual stories of constraints varied; however, themes of structural constraints were most salient, and therefore structural constraints are the focus of this report. Participants offered details describing an array of structural constraints, including time constraints and access issues. These factors constrained both visitors' ability and time available to get to the wilderness and also visitors' total time spent in the wilderness. Interview participants across cases identified the structural constraints as most impeding and these included both time and access issues specifically related to permit and campsite availability.

Time Constraints

Time constraints, including limited vacation time from work and family commitments, were an issue for 20 of the 25 participants. For some, restricted free time was a change that came with maturity and increased age. Justin's available time was impacted as he transitioned into adulthood: "When I was a teenager I had fewer demands on my time. It was easier to just take time and do things." As a youth, time was not such a constraint for James: "When I was back in school, you know I had plenty of free time and I would never miss a trip."

Children and other family commitments were important factors that determined available time for BWCAW visits. Eli explained the time constraints presented by family quite succinctly: "I'm married with children. That takes up a lot of your free time." Isaac noted that the time constraints due to family might not be permanent, but as long as he had a young child, free time would be quite limited. He explained, "Now that I have a family to raise, and my wife has also picked up extra shifts, it's definitely…free time has dwindled. I don't necessarily have large blocks of time to get out and enjoy the Boundary Waters." For some women, a new baby was the most constraining. Mandy had never missed a BWCAW visit until "last summer I couldn't go because I had a six-month-old baby that was breast-feeding."

Vacation and getting time away from work was also a time constraint identified by interview participants. Although she would like to visit every year, Susan has not gone to the BWCAW for the past two summers. She explained, "Time for me is more of a factor. Having the time to do it. Having the vacation." Ted described a "kind of a friction thing going on there with work" if he wanted to get away for longer than a weekend. Time off and vacation changed for Karen depending on her current job; she noted, "Right now I am working and a graduate student, so I have really no free time." Kali shared a similar story; her time away from her job was limited and she had "done some other shorter trips over a long weekend or something. A lot of day trips, it was really easy for me to do day trips."

Access Constraints

Access issues, such as permit restrictions and campsite availability, emerged as another important category of structural constraints. In terms of trip preparation and planning, difficulty obtaining a permit for the time and place desired occurred. Brandt noted that he first started visiting the BWCAW 19 years ago, but that now "it's harder to get permits sometimes; it's harder to go exactly where you want to go." Evan liked to go back to the same place every year, but after a few years he found he was not able to because "some access points are a little more difficult to get permits for."

In most cases, full campsites were not a constraint that prevented a visit to the BWCAW; instead this was an on-site constraint encountered during the wilderness experience. Reflecting on her recent trips, Charlotte commented, "I've had a few experiences now where we really struggled to get a site because they're all full." Rick shared a story about leading a group of high school youth and not finding an open campsite until after nine o'clock at night; he explained, "All the campsites seem to be taken and you have to go from one to another to find a campsite."

Permit availability and occupied campsites were both mentioned as constraints by Liz, who explained, "It can be such a battle to get a permit, and then when you do get a permit, those campsites when you get to an area where you want to camp can all be taken, and so you're forced to move on, and you know, that's a pain."

Impact on Visitor Behavior and Experiences

The structural constraints identified by interviewees had a variety of impacts on visitor behavior and experiences. Impacts included shortened experience, experience substitution, reduced opportunities for solitude, and adjusted trip planning.

Shortened Experience

As a result of structural constraints, interview participants shortened their BWCAW experience. Shortened experiences varied by individual and included a decrease in total trip visitation, staying fewer days in the wilderness, traveling a shorter distance, and base camping. Some participants skipped BWCAW trips or decreased their total trip visitation as a result of structural constraints. With a small child and both parents working, Isaac acknowledged that he no longer has "long blocks of time to get out and enjoy the Boundary Waters," and that he and his wife "are looking forward to the day when we'll have a little more time." For some women, a new baby reduced BWCAW trips. Mandy had never missed a BWCAW visit before, until "last summer I couldn't go because I had a six-month-old baby that was breast-feeding." Even with small children, Jessica was able to get away for a long weekend every summer; however, that window of time disappeared when she had a new baby. She explained, "I took a little break for a couple years because I had a baby, and then another baby."

Mandy explained planning her trip length: "I've gone on mostly shorter trips, like four days. I would love to go on longer trips, I just haven't ever been able to." Time away from work determined the trip length for Bill whose trips are always "four days.... That's usually the limit for work and for jobs." Family commitments also contributed to shorter trips. In the past, James's trips to the BWCAW were always a week long; now, since he is married with children, "trips to the Boundary Waters have gotten shorter in duration to where we'll maybe go in for just a half a week."

In addition to fewer days, shorter trips often entailed traveling fewer

Figure 2—Sunset in the BWCAW. Photo courtesy of Sierra L. Schroeder.

miles and staying closer to the entry points and BWCAW periphery. Karen reflected on a wilderness trip with a small child: "If I have a two-year-old, then clearly a shorter trip would be in order. If anything." For Marianne, bringing her children on a trip required changing some activities. With the kids, "we would take day hikes; we didn't do camping back in the Boundary Waters."

Related to this travel pattern, base camping, or staying multiple nights at just one site, was another impact on visitor behavior. Base camping and shorter trips were often associated; even when trip length was not shortened, the distance of the trip was shortened, and fewer miles were traveled in the wilderness when participants reported base camping. Mandy described her recent trips: "I've done a lot of trips where we just stay on one lake and that's where we are for the time." A base camp allowed Melissa to take advantage of the time she had available for her BWCAW trip: she was able to spend her time exploring during a day excursion instead of breaking camp and setting up again at another site. Her group "found a great camp site, so we did a base camp and then we just did a day trip out to another lake." Ted prefers base camping when he visits the BWCAW with his family; it is more convenient and they enjoy "really getting a sense of that area." Evan switched entirely to base camping over the last several years: "I've found an entry point where there's one 10 rod portage and then you can base camp on the next lake, so now it's a total easy man's trip!" According to James, time constraints make a big difference in his BWCAW travel pattern and "we haven't gone in as deep into the Boundary Waters through as many lakes and through as many portages. In the past, we'd go in and you know, hop campsites. Now we go in and we're just going to one campsite."

Substituting the Experience

Some interviewees also discussed finding different areas for the activities they enjoyed in the BWCAW. It had been many years since Karen's last visit to the BWCAW, and she discussed finding alternative areas for the activities she enjoys: "We actually went recently on a canoe trip down a river in southern Minnesota. So we have done some canoeing and kayaking-type things that are not in the Boundary Waters, but are substitutes." Although he has many fond memories of the BWCAW, Mark has not visited in more than 20 years and instead travels to his nearby lake house during the summers. He explained that now, lacking the time to get away to the BWCAW, "that's what I do. I go to the lake."

Reduced Opportunities for Solitude

Structural constraints and resultant changes in travel pattern had an impact on the social experience and opportunities for solitude, according to the interviewees. Participants found fewer opportunities for solitude: the inability to get farther into the wilderness resulted in more encounters.

On her shorter trips, Kali had more encounters with other visitors and never traveled enough distance to reach a less used area. She explained the impact on her experience during these short trips: "It's still relaxing, I mean, but you don't have the solitude."

Ted preferred to travel farther into the BWCAW, but he usually was not able to achieve his desired distance. He explained, "You really have to go in a lot further to get away from people, but then it requires more time, and generally I don't have one-week and two-week blocks of time to go experience the Boundary Waters." In contrast, Mandy and her dad would get their canoe towed by a motorboat in order to get away from crowded entry points and out past the periphery of the wilderness area. Mandy observed that, after achieving some distance with the tow, "There's fewer people; it's nice to be that far in and see less people."

Although she enjoyed reaching an area that was not as crowded, Mandy also acknowledged that she felt "kind of bad…sweeping past all these people that were paddling and paddling… probably their whole trip is just paddling on this lake."

The periphery of the BWCAW and entry-point lakes were perceived as the most frequently visited and crowded areas; this resulted in spatial displacement as visitors planned routes to take them farther into the wilderness interior. However, as more people are displaced from the edges of the BWCAW, the interior areas experience an increase in use. According to Kali, the entry-point lakes were likely to be the most crowded: "If you're going to go and you want your solitude, you want to go somewhere not on the main close lakes."

Gerald planned a trip "as far and deep as you can get into the Boundary Waters" in the hopes of finding unpopulated lakes and areas where he could experience solitude. After "four days of hard portaging," he arrived at a lake located in the central interior of the wilderness and commented that "we couldn't find a campsite, it was very populated. It just, it shocked me! I don't know what my strategy's going to be next year."

Trip Planning Adjustments

Access issue constraints, specifically obtaining a permit, influenced trip planning and travel pattern. Spatial displacement occurred frequently when a permit was not available for the preferred entry point; participants were likely to modify the entry location to negotiate the constraint. If he had trouble obtaining a permit, Brandt would "have to change plans and put in on a different entry point." After being displaced from his selected entry point several years in a row, he explained that now "I start by looking for what permits are available and then planning around that."

Some interviewees explained that planning ahead and making an early reservation was necessary to obtain a permit; however, others did not plan in advance and readily accepted whichever permit was available, even if it required a change in entry point. Even at the last minute, Charlotte has "always been able to get a permit"; at times she has "had to go in an obscure entry point, but nonetheless, I could go." Planning a trip only a week in advance, Mandy was displaced from her usual entry points. She was not disappointed; however, she explained, "I guess we're going to some crappy little small lake or something, 'cause that's just what's available. And that's fine with me, 'cause then you see lakes that you might not see otherwise." Although some interviewees were displaced from preferred routes or entry points, they were able to negotiate this constraint. In fact, obtaining a permit at the last minute or gaining entry to an obscure point in the wilderness was sometimes viewed positively.

BWCAW visitors experience a variety of constraints, in particular structural constraints, with time and access issues being the most impeding.

Discussion and Management Implications

In-depth interviews with 25 BWCAW visitors indicated that wilderness experiences are constrained, and that wilderness behaviors and experiences are impacted by the constraints. Structural constraints, such as time constraints and access issues, were encountered most frequently among our respondents. Impacts of the constraints on behavior and experience included shortened experiences, substituted experiences, reduced opportunities for solitude, and adjusted trip planning. As such, the results are similar to the breadth of constraints identified by research previously conducted across the leisure spectrum (Green et al. 2007; Shores, Scott, and Floyd 2007; Jackson 2005; Mowen et al. 2005; Jackson et al. 1993), but the impacts are unique due to the nature of the wilderness experience.

With regards to the limited wilderness recreation constraints research, similarities between these interviews and Green et al.'s (2007) analysis of national questionnaire data emerged. Specifically, the qualitative data detailed constraints identified quantitatively, such as time constraints, and added depth and breadth to an understanding of the resultant impacts. Whereas Green et al. reported constraints to wilderness visitation only, the results of this study documented visitation constraints as well as on-site constraints and the resultant impacts of such constraints. Interviewees shared stories of reduced opportunities for solitude and reported crowding in the wilderness area periphery.

The results of this study, particularly the relationship between time constraints and changes to spatial patterns of visitors, have implications for visitor management and planning. Issues of particular interest include visitor travel management, monitoring biophysical resource impacts, and long-term evaluation to better understand the visitor experience quality

and encounters with other users. Given that visitors indicated changes in travel patterns, renewed and reconsidered monitoring and management of BWCAW visitor travel is needed and in process. Based on the stories shared by visitors in this study, travel patterns have changed, and shorter trips and base camping are now more common; therefore, this is an opportune time to review the travel model employed in the BWCAW.

Biophysical impacts within the wilderness will be influenced as a result of the intrasite spatial displacement and changes in travel pattern described by respondents. Continued long-term monitoring of resource impacts is warranted. The number of encounters and impediment to solitude is of concern, particularly due to the legislative mandate for solitude experiences in wilderness areas.

Certain limitations exist in this study. First, although the nonrandom sample and small sample size provided important insights regarding structural constraints, the results cannot be thought of as statistically generalizable results (Patterson and Williams 2002). Second, results addressing interpersonal constraints were not reported here due to the limitation of word count for the article. Third, it is certainly possible that people are so constrained they have never visited the BWCAW.

A number of future research opportunities emerge from this study, but of particular interest are those related to coping in response to constraints. Coping is an integral part of the newly emerging constraints model (Schneider and Wilhelm Stanis 2007; Walker 2007), and it is important as it identifies visitor responses that can be predicted and managed. The existing wilderness coping research has assessed either an immediate response (Johnson and Dawson 2004) or a hypothetical response (Schuster, Hammitt, Moore, and Schneider 2006). Future studies on the actual use of coping mechanisms to accommodate or negotiate wilderness constraints will benefit from further examination of coping across time. Additionally, qualitative approaches may produce the rich data to provide managers a more comprehensive understanding of the depth and breadth of the coping process (Schneider and Wilhelm Stanis 2007). Like the wilderness constraints research, studies examining wilderness coping are limited (Schneider 2007). As coping research and the constraints model continue to evolve, studies focused specifically on wildlands and wilderness visitors will be critical.

Results from this study indicate that BWCAW visitors experience a variety of constraints, in particular structural constraints, with time and access issues being the most impeding. The impacts of these identified constraints included taking shorter trips, substituting BWCAW experiences in alternate areas, reduced opportunities for solitude, and changes to trip planning. The planning and management implications of these constraints and resultant impacts include monitoring visitor travel patterns, reviewing the BWCAW travel model, and ongoing long-term monitoring of biophysical impacts.

Acknowledgments

This research was supported in part by funds provided by the Rocky Mountain Research Station, Forest Service, USDA. We thank Alan Watson and the Aldo Leopold Wilderness Research Institute for their support.

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Continued from EDITORIAL PERSPECTIVES, page 3

Land Management; Jim Fazio, University of Idaho faculty; and Michelle Mazzola, University of Idaho Wilderness Research Center. Other colleagues followed as needed, and their service is much appreciated—thank you so much.

And finally, my good friends, Bob Baron, owner and president of Fulcrum Publishing and for years chair of The WILD Foundation, whose support was invaluable in launching and helping *IJW* survive, even with personal financial contributions in certain lean years; and Patty Maher of Fulcrum Publishing, whose editorial and design skill and good humor have been essential ingredients. *IJW* has been a team effort involving so many good people.

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Climate Change and Wilderness Fire Regimes

BY DONALD McKENZIE and JEREMY S. LITTELL

Abstract: A major challenge to maintaining the integrity of wilderness areas in a warming world will be adapting to changing disturbance regimes. Projections from both simulation models and empirical studies suggest that fire extent and probably fire severity will increase under the warmer drier conditions predicted by most global climate models. Projections are limited, however, not only simply because burnable area is finite, but also because water-balance dynamics may decouple existing relationships between drought and area burned across many landscapes, particularly forested wilderness areas. Disturbance interactions, and interactions between global warming and human-caused stresses such as air pollution, may compromise the ability of wilderness areas to respond to climate change. Adaptive strategies must be creative and flexible, especially considering the limited acceptability of active manipulations, such as assisted migration and fuel treatments, in protected areas.

Introduction

A major challenge to maintaining the integrity of wilderness areas in a warming world will be adapting to changing disturbance regimes. Projections from both simulation models and empirical studies suggest that fire extent and probably fire severity will increase under the warmer drier conditions predicted by most global climate models (Flannigan et al. 2001; Gillett et al. 2004; McKenzie et al. 2004). Outbreaks of cambium-feeding insects may also increase as insect life cycles accelerate (Logan and Powell 2001; Hicke et al. 2006) and host species become more vulnerable from drought stress (Oneil 2006). Disturbances are likely to act synergistically and be further affected by human-caused factors such as air pollution, extraction of resources, and land-use change (McKenzie et al. 2009). Wilderness areas will feel the effects of natural and human disturbances that originated outside their boundaries. For example, in the American West, regional haze inside park and wilderness areas often comes from sources hundreds of kilometers upwind (McKenzie et al. 2006).

It is essential that we understand the limits to projections of future fire. In the late 20th century, climate was the principal top-down control on the extent and spatial patterns of wildfire (Gedalof et al. 2005; Littell et al. 2009; Gedalof 2011). Climate drivers will continue to be important through the 21st century, but the quantitative relationships that are apparent from recent models, whether they be simulation based or empirically based, may change or be superseded by other controls. For example, annual area burned by fire cannot increase indefinitely into the future, even as warmer drier weather increases in both frequency and magnitude. Eventually there would not be the available biomass to sustain a perpetual monotonic increase.

In this article we briefly review model projections of future fire regimes and identify one particular limitation to projections that is based on the relationship of fire to broad-scale water relations. We also highlight uncertainties in models that are a result of a scale mismatch between the models and their application to wilderness landscapes. We focus on western North America, giving an example from four national parks, because this is the geographic area of our expertise, while suggesting that the water-balance dynamics have global application. We also briefly identify interactions of fire with other disturbances and give two examples of feedbacks and cascading effects. We conclude by examining contrasting strategies for adapting to changing fire regimes.

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Model Projections of Future Fire Regimes

Model projections, whether empirical or simulation-based, depend on (1) a predictive relationship between climate variables, or variables derived from these, and fire-regime elements (e.g., extent, frequency, severity, spatial pattern); and (2) climate projections from either global climate models (GCMs) or "mesoscale" (regional to subcontinental) climate projections based on GCMs. These latter are obtained from statistical downscaling of GCM output (Salathé et al. 2007) or regional-scale simulations that use GCMs to define "boundary conditions" (broad-scale constraints) for regional weather models (Salathé et al. 2008; Zhang et al. 2009).

Empirical models rely on statistical relationships between climate or climate-derived variables and fire-regime metrics. Most models at regional scales or broader predict area burned, either at annual or coarser resolution (Gillett et al. 2004; Littell et al. 2009, 2010), because of the lack of consistent databases for other variables such as fire frequency (McKenzie et al. 2000). Littell et al. (2009) used instrumental climate data and extracted dominant models of variability with principal components analysis to predict annual area burned at the scale of ecoprovinces (Bailey 1995) across the American West. Littell et al. (2010) did a similar analysis at the scale of ecosections (Bailey 1995) in the Pacific Northwest, United States, but used water-balance variables derived from a hydrologic simulation model (Variable Infiltration Capacity (VIC), Elsner et al. 2009) as the principal predictors. They applied climate projections from general circulation models and two socioeconomic scenarios from the Intergovernmental Panel on Climate Change (IPCC) to fire-area predictions through the 21st century. As with most other studies of this type, fire area is predicted to increase in a warmer climate.

Wilderness and other protected areas are especially vulnerable to fire and other disturbances because they are small, isolated, and sensitive to environmental effects from outside their boundaries.

Simulation models of future fire regimes link fire area and severity to landscape-to-regional patterns of vegetation and its succession over time. At coarse scales, vegetation is usually classified into biomes or physiognomic types and fire is modeled as the proportion of a particular unit of the spatial domain (e.g., a cell in a raster model) that burns in a given time step (Lenihan et al. 2008). At finer scales, landscape fire succession models (LFSMs) simulate fire initiation and spread explicitly, and their predictions may include not only total fire area but also fire severity and landscape spatial patterns (Keane et al. 2004). Analogously to predictions of increased area burned under future climate, LFSM projections consistently predict shorter fire rotations (Keane et al. in press). At both scales, increased fire occurrence and extent are strongly linked to drier and warmer conditions; model parameters are based on empirical research such as we described previously.

Limitations to Projections

We noted above that annual area burned cannot increase indefinitely into the future. This is a purely physical, or numerical, limit that confounds any projections from statistical models that predict monotonic increases. There are other limits or uncertainties to fire-regime projections, however, of which we consider two here in turn. The first—a true limitation—involves a change in the water-balance dynamic that drives regional-scale fire climatology. The second—better called an uncertainty—involves a scale mismatch between data and inference that is particularly relevant to "landscapes" (i.e., wilderness and other protected areas).

Littell et al. (2009) observed two contrasting regional-scale patterns in the key climate predictors of annual variability in area burned. A "northern" pattern, observed in forests of the northwestern United States, suggested the fuel condition was the key to predicting area burned. Regional synchrony of dry (flammable) fuels was associated with large fire years. In contrast, a "southwestern" pattern, in arid southwestern forests and rangelands, suggested that fuel abundance and connectivity were key. These contrasting dynamics hint of a threshold in the water balance beyond which the equation "hotter + drier = more fire," a necessary condition for projections of monotonic increases in fire in a warmer climate, may break down (see figure 1). Wet forests and desert grasslands clearly lie on opposite sides of this threshold. The key to predicting changes in wilderness fire regimes under global warming will be this phase transition for ecosystem types of interest, in conjunction with projecting changes in the vegetation types themselves. Here we provide a simple exercise to suggest potential outcomes. This should be taken as a thought experiment rather than a realistic projection, because of the simplifications and a number of limitations, including mismatches in spatial and taxonomic resolution.(see next page)

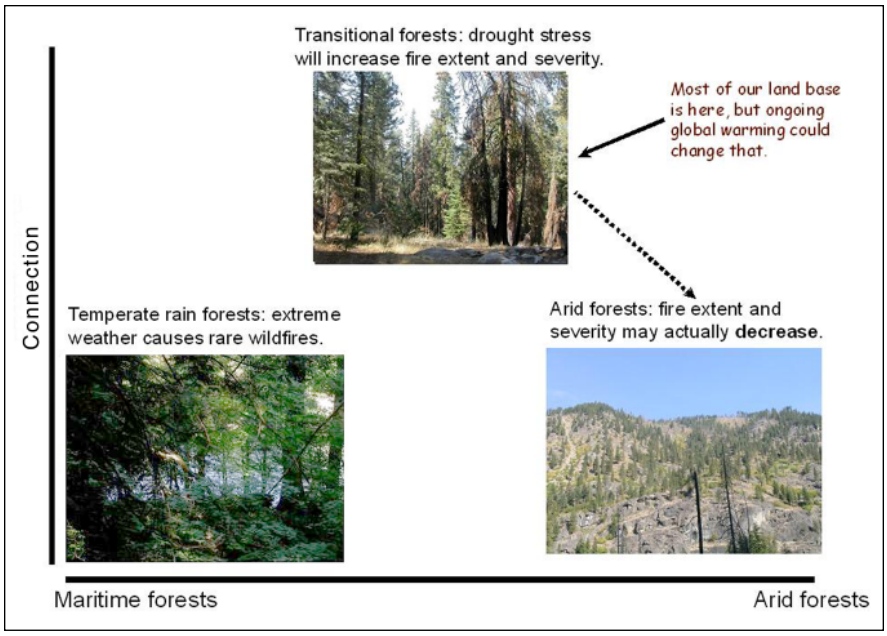

Figure 1—Diagram of the relationship between drought years and area burned for three types of forests; we ask whether the equation "hotter + drier = more fire" holds within these three types, or more precisely, at what points along the wet-dry gradient does the equation hold.

McKenzie et al. (1996) aggregated the potential natural vegetation for the United States from Küchler (1964) to a smaller number of classes with more clearly distinguishable fire-regime properties. In four national parks—North Cascades, Glacier, Yosemite, and Rocky Mountain—there are just a few of these classes, belying the complex vegetation patterns that exist in reality. McKenzie et al. (1996) further developed one-step transitions of vegetation types associated with the changes in fire regime (specifically more frequent fire) expected in a warmer climate. Within the four parks, we compared the initial vegetation to the "final" vegetation, qualitatively, as to which side of the phase transition between increasing fire and decreasing fire both occupied.

Results (see figure 2) for the two northern parks were not surprising; we expected these rugged landscapes to respond in complex ways and that the wetter one (North Cascades) might be more sensitive to increased drought.

In contrast, we did not expect the "complacency" of Yosemite and Rocky Mountain National Parks. Recent research (Lutz 2008) has suggested increased fire extent and severity in Yosemite in the future, and observations of the Hayman Fire of 2002 on the Rocky Mountain Front Range suggest unprecedented fire severity in this region may lie ahead. Nevertheless, with continued warming, vegetation in all of these parks would eventually reach a point at which forest biomass would be severely limited and fire spread would depend on surface (non-tree) fuels whose abundance is correlated with moisture availability in a given year.

Climate projections at global scales carry substantial uncertainty, but *ensemble methods*, where models are run while systematically varying important parameters, can quantify this uncertainty rigorously, improving confidence in the ranges of projections that are

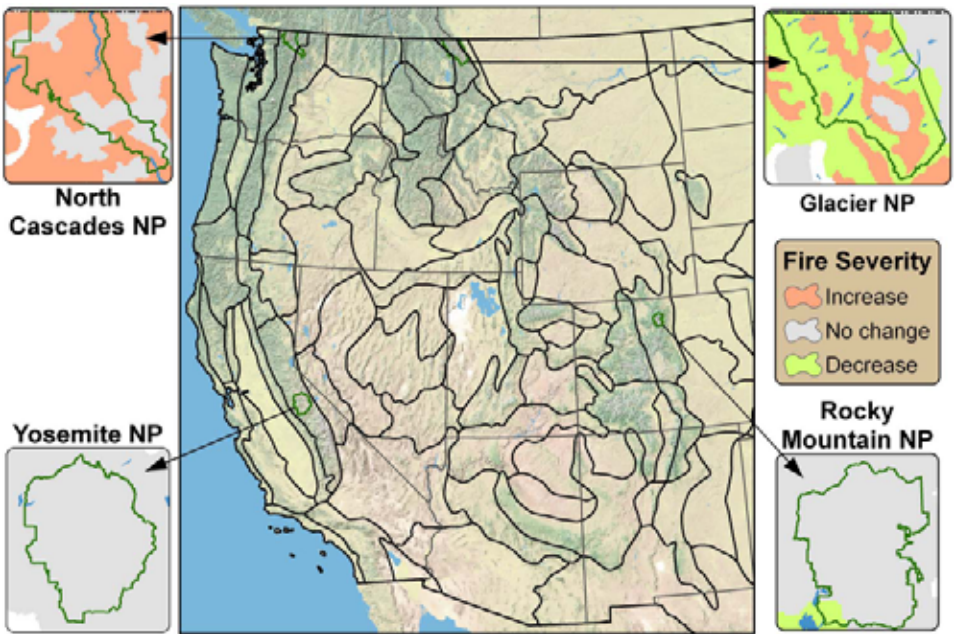

Figure 2—Expected change in annual area burned and (possibly) fire severity based on a subjective evaluation of the outcome of vegetation transitions based on McKenzie et al. (1996). Polygons on the main map are the Bailey (1995) ecosections. Increase in fire severity means that both initial and final types lie before the phase transition to a different water-balance dynamic, and that warmer climate means more fire. Decrease means that either both types lie after the transition, such that hotter + drier = less fire, or that the final type does. No change means that both are too close to the phase transition, but past it, for us to make a judgment.

made probabilistically (Intergovernmental Panel on Climate Change 2007). Downscaling climate models to finer spatial resolution, whether dynamically or statistically, increases uncertainties, and reaches a limit between ~ 4 to 12 kilometers (2.4 to 7.4 miles) resolution below which projections are known to be less accurate than at coarser scales (Salathé et al. 2007). Climate projections for individual wilderness areas or parks do not carry much confidence, therefore, because future microclimates depend on fine-scale relationships between the atmosphere and the land surface, which are as yet not well captured by climate models.

Similarly, fire dynamics are most complex and least predictable at intermediate scales (McKenzie et al. 2011). At the scales of forest stands or inventory plots, fire behavior and fire effects models function reasonably well, given accurate representation of local weather conditions. At regional to continental scales, aggregate statistics (e.g., annual area burned) can be modeled as a function of climate variables with reasonable success (Littell et al. 2009, 2010). The coupled uncertainties of climate and fire dynamics at "landscape" scales have confounded all but the most rudimentary attempts to project future fire regimes (Cushman et al. 2007, Keane et al. in press). Furthermore, none of these initial efforts has incorporated the nonconstant water-balance/fire associations that we discuss above.

Fire, Other Disturbances, and Cascading Effects

In the American West, and in much of the rest of the world, fire is an integral ecosystem process more than just an external perturbation. Fire acts at different spatial and temporal scales from other processes (including other disturbances), however. In particular, its pulsed nature contrasts with the relatively continuous processes of vegetation growth and succession, or the longer pulses (annual to multiannual) of insect outbreaks, making the analysis of interactions problematic (McKenzie et al. 2011). For example, the timing of bark beetle outbreaks vis-à-vis wildfire in lodgepole pine (*Pinus contorta* var. *latifolia*) forests of western North America determines whether fires are more or less severe than they would have been without insect disturbance (see figure 3). Dead needles that are still in the canopy provide a short pulse of very flammable fuels, increasing the intensity of crown fires (figure 3). Once these needles drop, fine surface fuels increase but canopy fuels decrease. Differential regeneration associated with cone serotiny and varying light levels in the understory from tree mortality, and

Figures 3a and 3b—Fire severity on the Tripod Complex Fire of 2006, north-central Washington State, United States, depends on previous insect disturbance. Photo 3a shows the stand unaffected by mountain pine beetle (*Dendroctonus ponderosae*) before fire, and 3b shows the stand with significant beetle-caused mortality before fire. Photos courtesy of C. Lyons-Tinsley.

the increase over time in large downed woody fuels (fallen snags), increase the complexity of modeling landscape dynamics. The bark beetle/wildfire interaction is notable for its ubiquity across western North America, but analogous questions obtain in other fire-insect systems (Jenkins et al. 2008).

If we extend the domain of fire-ecosystem interactions to other external and internal drivers, we can then seek quantitative models that take warming climate as a primary driver. McKenzie et al. (2009) built qualitative models of the effects of warming climate on "stress complexes," or cascading interactions among ecosystem elements that are intensified by warming temperatures. Figure 4 shows their model for the Sierra Nevada mountains in eastern California, United States. Three external forcings, all of anthropogenic origin (global warming, fire exclusion, and ozone pollution), amplify interactions among fire, insects, and succession to accelerate forest compositional change beyond that expected from global warming by itself. Proportional changes in the strength of each "arrow" in the complex will propagate through the system cumulatively, with increasing uncertainty at each step. This fairly simple thought experiment is illustrative of the peak in complexity of fire-ecosystem interactions at the "landscape" scale.

Adapting to Changing Fire Regimes

Given the near certainty that Earth will continue to warm through the 21st century regardless of global mitigation policies (Solomon et al. 2009), can protected areas be managed to adapt successfully to expected changes in fire regimes? If so, how will these approaches differ from adaptation efforts in lands managed intensively for other resources (Joyce et al. 2009)? Our work with public lands managers in the American West has shown that regardless of land use mandate, adaptation needs to be collaborative, local, and flexible to successfully incorporate regionally unique factors affecting adaptation strategies. At the same time, a broad conceptual approach to adaptation will inform the process so that it is proactive rather than only reactive and so that common resources and objectives can be entrained. Millar et al. (2007) provide a framework for focusing adaptation efforts that evolves as ecosystem change accelerates and fewer opportunities remain for maintaining current conditions. This framework identifies three stages: resisting change, promoting resilience to change, and allowing ecosystems to respond to change. Table 1 summarizes local and regional actions associated with each stage for ecosystems in which substantial management interventions are possible. Note that most of these options are unavailable for protected areas. Clearly, creative solutions are required to operate within management constraints (Miller et al. 2011).

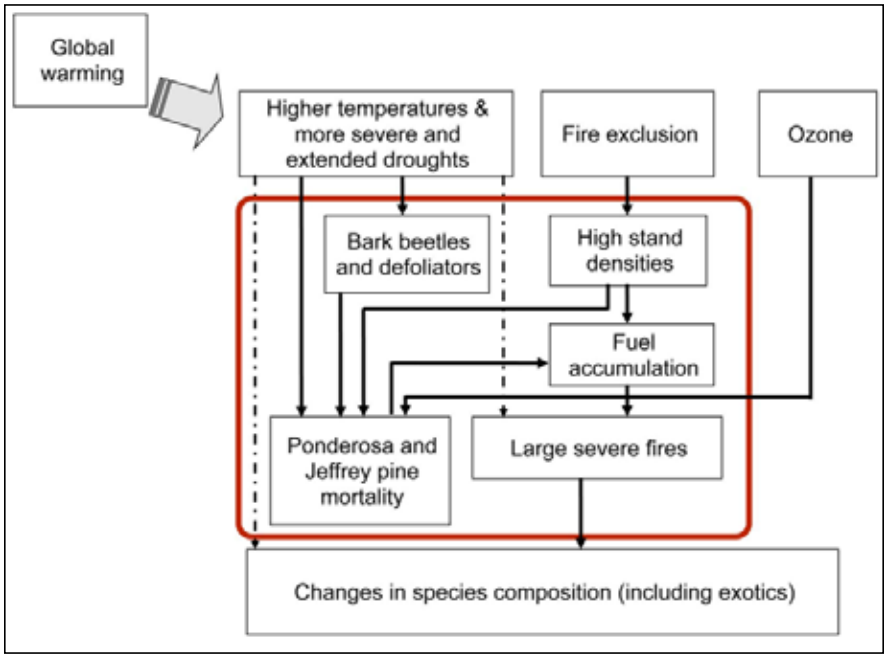

Figure 4—Stress complex in forests of the Sierra Nevada mountains. Adapted from McKenzie et al. (2009).

Conclusions

Fire and other disturbances will change in a warming climate in ways that may be counterintuitive and relatively abrupt as the Earth system reacts to the increased radiative forcing from greenhouse gas emissions. Wilderness and other protected areas are especially vulnerable to fire and other disturbances because they are small, isolated, and sensitive to environmental effects from outside their boundaries, valued by society in their current "equilibrium" state, and not available for the substantial manipulations that may help more managed ecosystems to adapt. Given that greenhouse warming is unlikely to abate soon, we can expect significant changes in protected areas in which fire is a dominant ecosystem process, in other words, most of them. These changes are expected to be rapid enough that attempts to maintain stationary conditions will likely fail, and adaptation must be dynamic and anticipate future landscape composition and

Table 1—Adaptation options (adapted from Littell et al. in press, after Millar et al. 2007).

Adaptation strategy strategy	Regional actions (policy)	Local actions (management)
Resist change	Minimize impacts of disturbance, suppress fire in systems where fire is rare, but maintain Wildland Fire Use (WFU).	Suppress wildfire in wildland-urban interface.
Promote resilience to change	Thin stands from below (to increase fire resilience); create uneven-aged structures or reduce density (to increase resilience to insects).	Use large disturbances as opportunities to establish new genotypes, and forest heterogeneity and diversity.
Allow forest ecosystems to respond to change	Plant new species expected to respond favorably to warmer climate.	Use new genotypes, or even species, in tree plantations.

structure associated with changing disturbance regimes.

Acknowledgment

An abbreviated version of this article was presented at the Symposium on Science and Stewardship to Protect and Sustain Wilderness Values: Ninth World Wilderness Congress; November 6–13, 2009, Mérida, Mexico.

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Continued on page 31

Youth Conservation Corps

Bring Native Youth Back to Wilderness

BY PAUL DAWSON and VICTORIA HOUSER

Wilderness has always been important to Native people. It is where they hunted, fished, and lived. It was their home and they were part of it. Some tribes have designated their own wilderness on Native lands in the United States to keep those places part of their heritage and still use them for subsistence and as a place for sacred events and cultural ceremonies (Rosales 2010; Tanner 2008; Aragon 2007). Similarly, the current relationships between national government protected areas and tribal or First Nation rights and ways of life in Alaska and Canada have been the subject of legislation and management planning with attention given to the rights and interests of these people while attempting to maintain the protection and continuation of these northern ecosystems (Whiting 2004; Sherry 1999). Such a balancing is difficult at best, as Sherry (1999) notes in the case of aboriginal interests and Canadian Arctic wilderness areas: "Wilderness protection that supports the diversity and productivity of northern ecosystems is a common western and aboriginal goal. However, dissonant perceptions of wilderness and discordant attitudes toward formalized wilderness protection still echo between the two cultures. Although there is no one aboriginal viewpoint, for many the land is synonymous with community and survival" (p. 17).

It is important for federal agencies and tribal groups to come to a common understanding about wilderness and its management, with both appreciating the other's beliefs, values, interests, and the laws governing management. One example of an attempt at a mutual understanding is occurring on the ground in southeastern Alaska between U.S. Forest Service (USFS) field staff and a local Native community of Kasaan in southeastern Alaska.

Native Village of Kasaan

The Kasaan is located on Prince of Wales Island, which is the third largest island in the United States. The village has about 50 residents and is very remote. The Kasaan Youth Academy (KYA) was designed to be an employment readiness program,

Paul Dawson doing wilderness trail work. Photo courtesy USFS.

Victoria Houser. Photo courtesy USFS.

and wilderness was the place for many of the program activities. Prince of Wales youth live in a rural area and can experience cultural, social, and economic barriers while trying to find employment. The KYA gave them on-the-job experience with the USFS through the Youth Conservation Corps (YCC) program and knowledge about future careers. The students not only worked outdoor projects, but also on résumés and job interview skills, and they learned about the rich culture of their Prince of Wales Island.

The KYA program was modeled after the existing YCC program, one of the longest-running federal youth employment programs. The KYA program tried to merge the ideas of wilderness with concepts such as the culturally important areas of their Native home and government management practices by bringing Native youth back to the wilderness areas on the Prince of Wales Island in southeast Alaska.

Support for the program started with funding from the Rueben E. Crossett Foundation to begin planning for the KYA. Funding was also received through a grant from Denali Commission, which was awarded to the Organized Village of Kasaan to pay for transportation, food, and supplies for the projects throughout the summer. The USFS received a grant through Alaska Regional Diversity Matching Fund to help pay for the internships and an adult crew leader.

The KYA program met on Fridays, and the participants in the KYA program were students from all over Prince of Wales: two students from Thorne Bay, three students from Kasaan, one from Klawock, three from Craig, and one from Coffman Cove. All of these students worked on YCC crews Monday through Thursday, except for the student from Coffman Cove, who worked in the Thorne Bay Ranger District office. Leadership was provided by three YCC adult crew leaders and a Youth Academy leader, who was in charge of planning the educational activities.

The Kasaan YCC worked on projects all over the island (see figures 1 and 2). The crew worked on sign installation at Salt Chuck Mine. Signs were installed that warned visitors not to collect subsistence food in the area due to the large amount of heavy metals in the water from the mine tailings. The crew also worked in Kasaan, which instills the students with pride in their community. The Organized Village of Kasaan has a totem park, clan house, and historic graveyard (see figure 3). Some of the totems were moved over from the old Kasaan village. The clan house was built by the Civilian Conservation Corps. Trail work such as raking, brushing, and cleaning up was done to the clan house trail. The students built and installed an information kiosk at the trailhead and replaced a set of old steps for the trail. Other Kasaan YCC projects included building a woodshed at Trollers Cove cabin, helping to build the Hatchery Creek Fish Pass, and building benches along One Duck Trail.

The Kasaan YCC crew had a great opportunity to do work in the Karta River Wilderness area (see figure 4). The crew spent a few days at the Karta River Wilderness cabin. During that time they learned about Leave No Trace principles, federal wilderness designation, and had time to reflect on and compare cultural values with the U.S. wilderness legal guidance for the management of designated wilderness. While they were in the Karta River Wilderness, they did some trail work and hiked up to the Flagstaff Mine site. Flagstaff Mine was active during the 1940s and is an important part of the history of the area; it also shows the large amount of impact that humans have had on the area. There are a number of buildings that have collapsed over the years and lots of machinery, including old vehicles. Part of the main trail in the area is on the old roadbed from the mine, and although it is more than 70 years old, it is still very obvious that it was once a road.

The Kasaan YCC crew went back to the Karta River Wilderness to stay at the Salmon Lake cabin, which is a historic cabin covered with cedar shingles. The crew filled the woodshed using hand equipment to gain experience with axes and crosscut saws, since the use of chainsaws is not permitted in a wilderness area. They installed new trail signs and cleared some of the trail, which had a number of downed trees.

It was important for the Kasaan YCC to visit this wilderness area because it helped the youth share cultural ideas and understand government management practices. The youth had firsthand experience with wilderness skills such as site monitoring, making resource management decisions, and using crosscut saws and other hand tools.

Figure 1—Kasaan community showing the kiosk built by the KYA YCC crew for Totem Trail. Photo by Paul Dawson.

Figure 2—KYA YCC students cutting firewood with the crosscut saw for the Salmon Lake Cabin in the Karta River Wilderness. Photo by Paul Dawson.

Figure 3—Kasaan cultural park and totem pole displays. Photo by Paul Dawson.

Figure 4—Salmon Lake in the Karta River Wilderness (39,889 acres/16,149 ha) is located on Prince of Wales Island and managed by the USFS. Photo by Paul Dawson.

Figure 5—Organized Village of Kasaan fish weir in modern-day Karta River Wilderness. Photo by Paul Dawson.

Native Communities Use of Wilderness Areas on Prince of Wales Island

At one time there were four Haida villages on Prince of Wales; however, sometime during 1911 these villages were consolidated and relocated for jobs and schools (i.e., Rural Schools Act). The villages of Old Kasaan, Howkan, Sukkwan, and Klinkwan collectively became Hydaburg and Kasaan.

Historically, the area that is now the Karta River Wilderness served as fishing and hunting grounds for the Haida people. It is currently used for subsistence fishing by people of Kasaan and Hydaburg, predominantly for its sockeye salmon fishery (see figure 5).

South Prince of Wales Wilderness was historically used as hunting and fishing grounds for the Village of Klinkwan (see figure 6), and it includes a private inholding within the designated wilderness.

The Maurelle Islands Wilderness was and is mostly used in one area at a place called Hole in the Wall (see figure 7). It is presently used as a fish-processing area for both the commercial fishing fleet and Native people. There is a shore tie-up for a floating dock at

Figure 6—South Prince of Wales Wilderness historic site of the Hunter Bay Cannery. Photo courtesy of the USFS.

Figure 7—Historic community life on what now is the Maurelle Islands Wilderness coast. Photo courtesy of the USFS.

Hole in the Wall where commercial fishermen sell their fish to a fish processor. The Native people work on shore processing their fish by smoking and canning the salmon for long-term storage. This area was and still is used by Tlingit people from the village of Klawock.

Coronation Island Wilderness was used historically by Natives to collect various species of seabird eggs. Also, there are several caves that probably provided shelter to Native peoples long ago.

Native Youth and Wilderness

There are many benefits to wilderness, such as recreation opportunities, education, scientific knowledge, psychological restoration, and other intrinsic benefits. Wilderness youth programs through experiences of solitude and wildness can reconnect Native peoples with their heritage and culture, while the youth get ready for employment in a world involving federal agency resource management, and Native and private corporation land management. After a very successful first year, there are plans to continue to find funding so that this beneficial KYA program can happen again in the future and possibly develop into a Wilderness Watchers program for Native youth to monitor wilderness conditions. By bringing Native youth back to the wilderness, it is easier for them to understand traditional uses and the way things may have looked to their elders. Traditional uses of wilderness should be preserved along with the wilderness itself, and it can reinstill a sense of pride in the Native people and the land.

Wilderness youth programs through experiences of solitude and wildness can reconnect Native peoples with their heritage and culture.

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Continued from CLIMATE CHANGE, page 27

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The Green Belt of Germany

BY TILL MEYER, LIANA GEIDEZIS, and KAI FROBEL

Till Meyer. Photo by Berny Meyer.

Liana Geidezis. Photo by BUND-Project Office Green Belt.

Kai Frobel points out a border post along the Green Belt. Photo courtesy of the BN-Archiv.

The English language has inherited quite a few words from the German language, such as "Blitzkrieg," "Angst," "Zeitgeist," "Rucksack," and "Hinterland." A special kind of hinterland was brought about by the "Iron Curtain," a human-made demarcation line that ran from the Barents Sea at the Russian-Norwegian border, along the Baltic coast, through central Europe and the Balkans to the Black Sea. The grimness of this political, ideological, and physical barrier was most powerfully expressed in former East Germany. Here, trespassers were punished relentlessly by the authorities of the Eastern Bloc. Metal fences, walls, barbed wire, guard towers, spring guns, land mines, and watchdogs had created a death zone, separating the nation into West Germany and East Germany (see figures 1a and 1b). This partition was harsh and inhumane, although it eventually created a zone of life. Since no land use was allowed along a linear feature of 1,393 kilometers (866 miles), nature flourished and wildlife proliferated largely undisturbed. On December 9, 1989, exactly one month after the Berlin Wall was officially opened, conservationists of East and West Germany met to pass a resolution that requested "the border strip between the Federal Republic and the German Democratic Republic should receive priority protection as a green belt and an ecological backbone of Central Europe."

The lack of conventional land use and the absence of most human-made disturbances in this zone had drawn the

Figure 1a—In the shadow of the inner-German border (here between Bavaria and Thuringia), with metal fences, mines, spring guns, and border patrols, an unspoiled "wilderness" was created where nature quietly took over and wove a network of habitats. Photo by Kai Frobel.

Figure 1b—The Harz border path running through National Park Harz along the Green Belt is sticking very close to the former border and runs to a large extent on the former "border patrol path." Photo by Harzklub.

Figure 2a—In intensively used agricultural areas, the Green Belt is irreplaceable as a last ecological network and retreat for animals and plants, including between Thuringia and Lower Saxony south of the Harz Mountains. Photo by Klaus Leidorf.

Figure 2b—Saxony is the first German federal state that protected its entire part of the Green Belt as conservation areas such as here, where nature-conservation and habitat-connecting measures created a continuous ecological network with buffer zones around it. Photo by Klaus Leidorf.

curiosity of conservationists as early as 1975. In 1979, the BN ("Bund Naturschutz in Bayern," which is the Bavarian subdivision of Friends of the Earth Germany) started a systematic ornithological survey on a stretch of 140 kilometers (87 miles) along the inner-German border. This survey covered the immediate border zone, and—for comparison—large tracts of adjacent farmlands, encompassing a study area of 1,005 square kilometers (370 sq. miles). The results show that 90% of some highly endangered bird species, such as whinchat (*Saxicola rubetra)*, red-backed shrike (*Lanius collurio*), European nightjar (*Caprimulgus europaeus*), and the woodlark (*Lullula arborea*) all preferred to breed inside the narrow border strip and avoided areas of agrarian cultivation.

With end of the Cold War in 1989 and the political détente of the 1990s, the military and political angst declined, but the rare birds and much of the undisturbed nature remained. Due to the efforts of conservationists on federal, state, and regional levels, the majority of the Green Belt is still intact. This tapestry with a width of 50 to 200 meters (164 to 656 ft.) runs through almost every type of German landscape, from the coast to lowlands and low mountain regions (see figures 2a and 2b). More than 100 different habitat types, such as fallow grassland, shrubland, dry grassland, pioneer forests, wet meadows, water bodies, and bogs cover an area of 177 square kilometers (68 sq. miles) (Schlumprecht et al. 2002). Half of the area consists of endangered habitat types; about 16% of it is covered by priority Annex I habitats (European Union 1992). In 1996 the Green Belt suffered an ecological setback (although it was also a long overdue humanitarian gesture). The "borderland law" was ratified, which allowed former landowners who were disowned by the government to buy back their land for 25% of its value. Today, 20% of the Green Belt is privately owned, with more than half of this transferred to industrial agriculture; 13% is under municipal or communal possession; and around 2% has been bought up by nongovernmental organizations, mainly the BUND (Friends of the Earth Germany). The biggest portion (65%) belongs to the federal government of Germany.

Then, in 2003 came what at first seemed to be a breakthrough for the formal protection of the Green Belt. After intensified lobbying by the BUND and other groups, the German government, under chancellor Gerhard Schröder, agreed to turn over the borderlands to the custody of the states for conservation purposes. In 2005, the subsequent cabinet of chancellor elect Angela Merkel formally recognized the Green Belt as a National Nature Heritage site. In a "contract of coalition" in 2005 it was agreed between the governing parties to turn over the borderlands either to a federal conservation foundation or to the states for the purpose of conservation. Whereas the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety wanted to proceed with this, the Ministry of Finances devised ways to turn the transfer into a costly procedure for the prospective owner, thus discouraging state governments and conservation foundations from accepting the federal gift of land.

After many negotiations, a transfer of 38 square kilometers (14.6 sq. miles) of the Green Belt to the state of Thuringia was validated in 2008 (see figure 3). As of today, 28% of the Green

Figure 3—The Thuringian Forest and Franconian Forest areas are a densely wooded region with agriculture. The emergence of birch trees and spruces are driving out open landscape habitats such as mountain and wet meadows as well as dwarf shrub heaths. Photo by Frankenwald Tourismus.

Belt is formally protected as nature conservation areas, 38% is registered under either the European Bird Directive (European Union 1979) or the European Habitats Directive (European Union 1992). About 85% of this area is considered intact, meaning that most of these lands have not been degraded by intensive farming.

Successful protection of the Green Belt does not mean absence of all agriculture. Instead, the idea, according to the BUND is "to encourage as much plant succession as possible while at the same time allowing as much cultivation as necessary." This meant that large portions of the Green Belt were subjected to nonintervention management, whereas in others parts, farmers were to manage for a mosaic of perennially rotating fallow tracts of land alternating with forms of extensive (sustainable) land uses and habitat maintenance (see figure 4). Most often these interchanging modes of management are aimed at achieving a semiopen cultural landscape (Kulturlandschaft), which was characteristic for most of the countryside prior to World War II when industrial agriculture had not yet gained much ground. Many species that historically profited from low-key cultivation can today again be encountered at or near the Green Belt, some of these Kulturfolger (followers of cultivation) are white stork (*Ciconia ciconia*), gray partridge (*Perdix perdix*), and European hare (*Lepus europaeus*).

These conservation successes were not unanimously welcomed; they also raised some opposition. For decades the border zone (Zonengrenze) had the reputation of being an economic void, a hinterland, where only the hapless population remained, condemned to frugal livelihoods by the lasting Cold War between the eastern "communist" and the western "free" bloc. As the Iron Curtain was lifted, some local people felt that now the conservation movement had become their new enemy, by infringing on their newly gained freedoms.

A few far-thinking conservationists, aided by historians, politicians, and entrepreneurs, recognized that the presumed ill fate of the hinterland was also its special chance, a kind of unique selling proposition. The idea was (and still is) that both the historic landmarks and the ecologically intact areas could be turned into economic assets. Thus, it would help the local residents to a "piece of the cake" without having to use it all. With the help of tourism experts and local business people, the BUND developed several dozen bookable tourist packages for three model regions. The project was funded by the

Figure 4—The Eichsfeld region (Lower-Saxony/Thuringia) is a traditionally used agricultural landscape where the Green Belt runs as a strip of natural grassland and shrubland through arable land. Photo by Heinz-Sielmann-Stiftung.

Federal Agency for Nature Conservation (Bundesamt für Naturschutz, or BfN) and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

For example, a tour of the Green Belt Germany at Lenzen Castle, which is about a two-hour drive southeast of Hamburg, is the highlight of the northernmost Elbe-Altmark-Wendland model region (see figure 5). This medieval castle is located amidst the UNESCO Man and Biosphere Reserve called River Landscape Elbe. It now harbors a hotel and a nature center, the latter run by the BUND. Lenzen Castle is the starting point for many excursions into the riparian landscapes of the Elbe River. If one chooses the winter season for these outings, it is possible to encounter migrating Arctic geese such as brent (*Branta bernicla*), barnacle (*Branta leucopsis*), and bean (*Anser fabalis*), as well as whooper swans (*Cygnus cygnus*), avocets (*Recurvirostra avosetta*), greenshanks (*Tringa nebularia*), and redshanks (*Tringa totanus*).

Figure 5—The Green Belt Germany is 1,393 kilometers (866 miles) long and passes 17 distinct physiographic regions, from the Baltic Sea to the intersection between Saxony, Bavaria, and the Czech Republic. Apart from the course of the Green Belt, the map shows the three model regions for nature-tourism along the Green Belt within the project "Experience Green Belt." Graphic courtesy of the BUND-Project Office Green Belt.

The decades of remoteness that politics imposed on the land left quite a few wetlands and rivers untouched. However, earlier development such as the excavation of gravel pits, draining of bogs, and channelizing of rivers had produced considerable scars on the land. The challenge of reconnecting and restoring these habitats was undertaken and produced a remarkable landscape of wetland and floodplain forests. Here one can witness—twice annually—what American author Aldo Leopold once described as "a pandemonium of trumpets, rattles, croaks and cries that almost shakes the bog with its nearness, yet without disclosing whence it comes." Cranes! During the migration in fall and spring, hundreds of European cranes (*Grus grus*) can either be seen passing overhead in their characteristic delta formations or feeding in large flocks between the corn stubble on the fields. These large birds have made an incredible comeback not only in Germany, but all over Europe. Another bird species that is on the rebound is the majestic white-tailed eagle (*Haliaeetus albicilla*), which can often be seen circling high in the skies above certain regions of the Green Belt.

Even though the eagles and most of the migrating and wintering birds are easy enough to detect on autonomous hikes, it is advisable to hire a guide. Guides not only know their biology, but are also well-versed in local history. For instance they can lead their groups to eerie remnants of brutal 20th century despotism such as abandoned and razed towns. After World War II, their inhabitants were forcefully evicted by the authorities in order to clear the land for constructing the border fortifications. Today the sites of the former settlements are submerged in near wild conditions with telltale plant species such as lilac (*syringa* sp.) and mirabelle plums (*prunus domestica* var. *syriaca*), along with thick mats of periwinkle (*Vinca minor*) covering old structures such as basement entrances.

About 250 kilometers (155 miles) to the south, where the Green Belt winds right through the National Park Harz, we pass through a veritable picture-book Germany with small towns of predominantly ancient Fachwerk (half-timber) houses nestled in the

Figure 6—Mikhail Gorbachev at the opening of the WestEastern Gateway, a land art project initiated by BUND in the "middle" of the Green Belt Germany in the Eichsfeld region, showing his Green Belt–shareholder certificate. This was also the natal hour of the European Green Belt idea, suggested there by Professor Hubert Weiger (BUND) and Professor Hartmut Vogtmann (former president of the German Federal Agency for Nature Conservation, BfN). Photo by Jürgen Schmidl.

hills. The National Park Harz was established in 2006 when two adjacent national parks in two separate federal states were merged. Encompassing 247 square kilometers (95 sq, miles), it is Germany's largest forested national park. Its resident wildlife species include red deer (*Cervus elaphus*), wild boar (*Sus scrofa*), and roe deer (*Capreolus capreolus*). Species that were extirpated in the last century, such as European lynx (*Lynx lynx*) and capercaillie (*Tetrao urogallus),* have been successfully reintroduced here.

In the Harz, natural and cultural history converge as numerous publications remind us that 19th century literary celebrities Heinrich Heine and Johann Wolfgang Goethe had visited the area several times and had climbed its highest peak, the Brocken, at 2,241 meters (7,352 ft.). Even though this altitude is well below alpine elevation, the peak is naturally treeless due to its harsh climate, which resembles that of high mountains. Here you can find plants such as Mountain heath (*Phyllodoce coerulea*), birds such as the common crossbill (*Loxia curvirostra*), crested tit (*Lophophanes cristatus*), spotted nutcracker (*Nucifraga caryocatactes*), and Eurasian siskin (*Carduelis spinus*) can be heard on its slopes. The frequent fogs on the summit, in concurrence with certain light, temperature, and moisture conditions, create an optical effect known as "Brocken Gespenst" (Brocken spectre). This phenomenon might have been one reason why the Brocken became the site for the legendary Walpurgis Night, the annual dance of witches and devils on the night before May 1. In reference to this lore, certain granite formations on top of the Brocken summit were named Witches' altar and Devil's Pulpit. A scene in *Faust*, a seminal drama by Goethe, is titled "Walpurgis Night," a fact that is used today to attract visitors to the Goethe Trail of the national park, claiming that the "climb through the rough terrain in heavy snow left a lasting impression on the poet. The experience of untouched nature and the joy of having reached the summit gave him new creative impetus".

A recent event with the potential to make history known as "the West Eastern Gateway" took place in the Thuringian region on June 9, 2002 (along with a financial donation by Federal Foundation for the Environment, DBU). On this day when a habitat inventory of the Green Belt funded by BfN was presented, a crucial protagonist in the eastern-western détente, attended; Mikhail Gorbachev, who attended as the chair and founder of the International Green Cross (see figure 6). This environmental organization was formed in 1993 with the mission "to help ensure a just, sustainable and secure future for all by fostering a value shift and cultivating a new sense of global interdependence and shared responsibility in humanity's relationship with nature." Gorbachev listened carefully as Professor Hubert Weiger, the chair of the BN (the Bavarian branch of BUND), suggested for the first time in front of a public audience that "a Green Belt running through Europe," should be implemented, "as a symbol of reunification between East and West."

The next impetus for a Green Belt of Europe came from the Federal Agency for Nature Conservation when in 2003, it organized the first international conference in Bonn, and various preliminary initiatives in Scandinavia and in the Balkans were presented.

The former military zone that separated a nation, a continent, and the world has turned into a tapestry of biodiversity and a popular travel goal for tourists.

Mikhail Gorbachev then acknowledged: "I think our German comrades had a very good idea. Now under new circumstances, when we have moved away from the confrontation and from a potential rift in Europe, we want to be united by a single green network. I am delighted to say that environmental activists are working at the Russian-Finnish border, and are looking into plans to create a Green Belt there" (Gorbachev 2003).

Today, the concept of the Green Belt of Europe has increased and physically stretches through 23 nations over a length of 12,500 kilometers (7,750 miles) (Geidezis and Kreutz 2006). Organizationally the Green Belt is held together by International Union for Conservation of Nature (IUCN) Europe, and three regional coordinators who initiate and conduct a program of work (Lang 2009), and it is scientifically supported by a GIS mapping project (Schlumprecht et al. 2009) that continues to identify the areas of concern and the gaps, which need urgent attention. Much needs to be done to increase the effective permeability of the Green Belt of Europe, even though its raison d´être as an ecological refuge and corridor has already been shown for a huge array of species, all the way up the trophic pyramid to the brown bear (*Ursus arctos*), wolf (*Canis lupus*), and lynx (*Lynx lynx*). Large herbivores, most notably the European moose (*Alces alces*), have been verified as regular visitors to Bavaria. The idea of these now regularly occurring sojourns of large ungulates would certainly have been considered ludicrous in the 1970s. At that time, a whinchat perching on a border post to a forbidden hinterland was enough to get enthusiasm going for the ecological reunification of Germany (see figure 7).

Figure 7—Whinchat (*Saxicola rubetra*) sitting on a post of the former GDR (German Democratic Republic). Whinchat cannot survive in intensively used agricultural landscapes, and the Green Belt offers habitats such as fallow grassland and shrublands. Photo by Thomas Stephan.

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Walking Tracks and Environmental Impact on an Urban Forest Remnant in Rio de Janeiro, Brazil

BY JOSÉ G. B. DERRAIK and LUIZ ALEXANDRE VALADÃO

Although ecotourism is recognized as a potentially valuable tool for sustainable development, it may lead to environmental impacts. Walking tracks, which can be perceived as being associated with low-impact activities, may be deleterious when the frequency of visitors is high and the area is not properly managed. Such is the case for urban forests in the city of Rio de Janeiro (Brazil), an example of which is discussed in this article. Walking tracks have the potential to bring positive social outcomes to developing nations, but an adequate management plan needs to be in place to mitigate possible ecosystem impacts.

Introduction

The United Nations Environment Programme (UNEP) has recognized ecotourism as a valuable tool for sustainable development, with the potential to sustain local communities while protecting the environment (Doan 2000; UNEP 2001). There are numerous definitions of *ecotourism* (Fennel 2001; Higham and Lück 2002), but in Brazil it seems to apply to any activity that brings people in close contact with nature that, in theory, causes no deleterious effect on it. However, *ecotourism* is a term so variedly used as to become almost meaningless (Paul Dingwall, pers. comm. 2003).

Although the deleterious effects of recreational activities on ecosystems are still poorly understood (Doan 2000), their impact has been documented in several studies (e.g., Cole and Marion 1988; Farrell and Marion 2001; Johnson 1967; Liddle 1975; Obua and Harding 1997), and these are positively correlated with frequency of visitors (Cole and Landres 1996; Obua and Harding 1997). Cessford and Dingwall (1997) discussed many effects associated with walking tracks:

Longtime friends and climbing partners Luiz Alexandre Valadão (left) and José Derraik (right) on Pão-de-Açúcar (Sugar Loaf). The area is surrounded by Floresta da Urca, an urban haven in Rio de Janeiro, Brazil.

impacts on flora (such as trampling of plants, tree bases, and roots), promotion of accelerated drainage, as well as soil compaction and structural disruption. Further, there are deleterious effects on fauna, such as behavior modification, deliberate and unintentional feeding of wildlife, not to mention the direct impact of collecting and hunting (Cessford and Dingwall 1997). The presence of visitors in remote areas may also expose free-ranging wildlife to diseases, such as the tuberculosis outbreak among banded mongooses (*Mungos mungo*) in Botswana (Alexander et al., 2002). However, to detect these environmental impacts, it is necessary to invest time and financial resources in adequate monitoring, which seldom takes place, particularly in the long-term.

There is anecdotal evidence that an increasing number of visitors are utilizing walking tracks in natural areas in Brazil, where such activities appear to be mistakenly perceived as "low impact" (Embratur 2001). In this article, we discuss the impact of a walking track on an urban remnant of the Brazilian Atlantic coastal forest.

Rio de Janeiro's Atlantic Forest, Walking Tracks, and the Degradation Process

Several of Brazil's natural areas are under threat, two of which were listed among the biodiversity hotspots of the world (Myers et al. 2000). One such area is the Mata Atlântica (Brazilian Atlantic Forest), which is arguably the most biodiverse ecosystem on the planet (Rocha 2000). In view of its global significance, the Mata Atlântica Biosphere Reserve was established in 1992 by UNESCO (Diegues 1995). This ecosystem has already been overexploited (Dean 1997), and little of the original forest cover is left. It is estimated that 97% of the area of the state of Rio de Janeiro was once covered by the Atlantic Forest, which is now reduced to about 20% (Tanizaki-Fonseca and Moulton 2000). Approximately 5% to 10% (ca. 29,000 km^2/11,197 mi^2) of its original area remains in the whole country (Fonseca 1985; Diegues 1995).

Lowland forests in their natural state are rapidly diminishing globally. Such areas are usually of economic significance, and, consequently, have been steadily replaced by settlements and agricultural land. Along the Brazilian coastline, little remains from the original cover of lowland forest ecosystems, with the larger remnants persisting in sites of more difficult access, as is the case in other countries, including New Zealand (Department of Conservation and Ministry for the Environment 2000).

The state of Rio de Janeiro harbors some of the largest remnants of the Atlantic Forest (Diegues 1995). In the city of Rio de Janeiro, however, even areas within national parks have been affected through illegal encroachment of human settlements, which occurs mainly via the expansion of *favelas* (slums), but occasionally also through the establishment of dwellings for the wealthy. Nonetheless, there are small remnants of the original Atlantic Forest cover that persist outside national parks and reserves. Most have undergone some level of modification, but may still harbor animal and plant species of conservation significance. In the city of Rio de Janeiro, one such area is likely to be Floresta da Urca (Urca Forest), which covers an area of about 50 hectares (124 acres), occupying the slopes surrounding two granite gneiss outcrops, Morro da Urca and Pão-de-Açúcar, on the shores of Baía de Guanabara (Guanabara Bay) (see figure 1). The area is located at the narrow (and only) entrance to Guanabara Bay, and is considered to be of national security importance, having consequently been controlled by the military for more than four centuries, which has protected the area to some extent.

Pão-de-Açúcar (Sugar Loaf) is a major national and international tourist destination. Although it has not been officially awarded the status of a park under any jurisdiction (municipal, regional, or national), it is protected as a "natural monument" under municipal (Prefeitura da Cidade do Rio de Janeiro 2006) and federal laws (Rambaldi et al. 2003). The local inhabitants are attracted to the area by its striking beauty, enhanced by the presence of a pleasant beach and the perceived safety provided by the 24-hour presence of the military. A paved walkway about 1.3 kilometers (.81 mile) long allows visitors to walk around the southern side of the mountains, providing easy access to the forest remnants. Until relatively recently, the tracks within these remnants were narrow and used primarily by rock climbers and a few locals. In the past two decades, however, the frequency of visitors to one particular track (leading to the cable car station on top of Morro da Urca) has increased considerably, leading to extensive erosion.

Although no data are available to quantify the actual impact, in early 2004 the deterioration of the forest surrounding the main track was already

Figure 1—Aerial photograph of Floresta da Urca (© 2010 photo by Google Earth).

Figure 2—Photographic evidence of environmental impact at the walking track at Floresta da Urca (February 2004). The original track was relatively narrow, but visitors move to the flanks using trees as an aid, frequently uprooting trees and steadily widening the path. Photo courtesy of authors.

blatant, with many physical effects being easily observed. Photographic evidence taken in February 2004 illustrates the erosion process (see figures 2, 3a, 3c). Several trees were uprooted and had consequently fallen (see figures 2, 3a, 3c), particularly in steeper sections. Numerous other trees were precariously standing, with large sections of their root system exposed and/or damaged (see figures 2, 3a).

As the erosion made the track increasingly bare and slippery, people moved to its flanks, clinging on to the surrounding trees as aid during ascent and descent, increasing the stress load on the plants and aggravating the degradation pathway. The numerous visitors using the track and Rio's characteristic torrential summer rains exacerbated the process, as most visitors would avoid the slippery track and create shortcuts through the surrounding vegetation. As a result, the area affected by erosion was constantly deepening and widening.

This situation at Floresta da Urca is representative of the environmental impact occurring in other Atlantic Forest remnant sites in the region. For example, in the heart of the city of Rio de Janeiro lies the Parque Nacional da Tijuca (Tijuca National Park), one of the world's largest urban forests (32 km^2/12 mi^2), most of which was replanted or regenerated in the 19th century, since the original forest had been replaced primarily by coffee and sugar cane plantations (IBAMA 1998; Freitas et al. 2006). The Parque Nacional da Tijuca still harbors important floral and faunal species, including birds and mammals of conservation significance (Freitas et al. 2006). Unfortunately, many of the tracks at Parque Nacional da Tijuca also show signs of extensive erosion due to unmanaged human visitation, similar to those observed at Floresta da Urca.

At Urca, however, instigated by the total inaction of authorities, volunteer organizations led by the local climbing federation decided to take some action to mitigate the track's steadfast degradation. The work on the track started in 2005, primarily consisting of building steps on steeper sections and fencing off shortcuts (see figure 4).

Despite the relatively rudimentary nature of the work carried out, the positive impact on many areas of the track is clear. In a number of steeper sections the erosion has been considerably reduced (see figures 3b, 3d). The steps allowed for easier progress up the track, minimizing the use of shortcuts and the consequent trampling of tree roots and surrounding vegetation (see figure 3b). Volunteer maintenance work appears to continue as, despite a formal agreement with the city council's environmental agency, little or no funding has been provided to assist in its maintenance (Waldecy Lucena, pers. comm. 2009).

Unfortunately, however, there has been a simultaneous and exponential increase in the number of visitors utilizing the track, although there is no actual data to adequately quantify it. The number of ecotourism ventures currently taking groups to the area is large (pers. obs.), and certainly many times above the carrying capacity of the existing track. For many people, the area is apparently seen as a gold mine, since it is easily accessible and there are no costs

Figure 3—Further evidence of degradation of the walking track at Floresta da Urca in February 2004 (a, c), and the same sections in April 2009, showing some improvement following the track recovery work (b, s). Photo courtesy of authors.

associated with its use. Ecotourism is a completely unregulated business in Brazil, and literally anyone can proclaim him- or herself to be a guide. As a result, numerous so-called guides can be seen leading very large groups (including dozens of people at a time) into the area (pers. obs.). We observed that about 400 people per hour were passing through the track during a sunny autumn weekend. This huge influx is now also causing problems for the company that administers the Sugar Loaf cable car, with thousands more people utilizing their facilities at the station on Morro da Urca (Waldecy Lucena, pers. comm. 2009). As a result, the level of impact to the area is increasing, and, for example, the steps created cannot withstand the unforeseen influx of people in the long term. The current frequency of visitors, although not quantified, is certainly unsustainable in view of the complete lack of a management plan for the area.

One could argue that rather than protecting the forest, the easier access provided by the steps on steeper section may have actually helped boost the frequency of visitors, increasing the pressure on the local ecosystem. Although the work of the volunteer groups has been very laudable, the lack of proper oversight, funding, and a long-term management plan threatens the viability of the walking track at Floresta da Urca. Thus, this case shows that in areas with a high frequency of visitors, only an adequately funded management program would likely be effective in protecting the local ecosystem.

Problems and Potential Solutions

In the case of Floresta da Urca, since prohibition of human visitation would be unlikely and undesirable, only extensive track management would prevent further degradation and allow the ecosystem to recover. Management measures could include the adoption of proper stairways, adequate educational signage, as well as proper closure of existing and potential shortcuts.

Unfortunately, there are no available examples of adequate walking track management of such areas in Brazil. Further, there seems to be an apparent lack of scientific input into tourism policy making and management in the country, particularly in relation to walking tracks. A 2001 workshop sponsored by Embratur (Brazilian Institute of Tourism) sought to prepare the National Plan for the Sustainable Development of Adventure Tourism (Embratur 2001), which would be used as a guideline for future policies. The environmental impact of different adventure sports was subjectively assessed, based on the perception of the members of the panel, who concluded that hiking causes minimum or no environmental impact. If such unrealistic ideas were to be reflected in government policies, it would open the way for uncontrolled access to areas of major ecological significance, with no management measures in place to control visitors' use and ensure maintenance of tracks.

Woodley (1993) suggested that the tourism industry should be treated in the same way as other industries, such as mining. Some level of monitoring and control is essential in order to ensure that impact is minimized and greed for short-term profit does not lead to more unsustainable environmental exploitation. Further, the use of walking tracks can be a sustainable activity, as long as they are properly managed. Adequate monitoring not only ensures that impact is minimized, but also creates a feedback loop to allow the establishment of any necessary mitigating measures, such as reducing the number of visitors allowed at any given time. Moreover, the use of signs and displays can provide useful and interesting information, while educating people and encouraging them to be environmentally conscious.

Thus, in the case of the state of Rio de Janeiro, it is necessary to ensure that sustainable practices are in place, not only to minimize the environmental impact in areas of conservation significance, but also to secure future generations access to such locations—especially since other important conservation areas in the state are already threatened by tourism, such as Parque Estadual da Ilha Grande (Alho et al., 2002). In the case of city of Rio de Janeiro, urban forest remnants of considerable size are still present, despite its large population.

Importantly, one cannot underestimate the socioeconomic value of

Figure 4—Examples of the recovery work carried out by volunteer groups at Floresta da Urca. Photo courtesy of authors.

such areas. The experience of visiting native forests would likely be widely beneficial, particularly since Rio's forest remnants are accessible to a relatively large low-income population that would otherwise be unable to afford the costs associated with ecotourism.

The main obstacle is that similar levels of scientific and administrative input as those adopted in countries such as New Zealand are unlikely to occur in Brazil and in other developing countries. As a result, unsustainable growth of ecotourism in the form of unmanaged and increasing visitor frequency to areas of conservation significance could cause considerable environmental impact, without bringing any social or economical benefits to local communities. Ecotourism in the form of walking tracks has the potential to attract tourists and bring positive outcomes to developing nations, but an adequate management plan needs to be adopted to mitigate possible ecosystem impacts. It is likely that such plans would need to be developed on a case-by-case basis, as it would be at Floresta da Urca. This would be necessary to ensure that the local needs are met, and that the locally relevant issues are given the appropriate consideration.

Acknowledgment

We thank Paul Dingwall and Waldecy Lucena for valuable input, and Google for allowing "fair use" of their aerial photograph.

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Announcements

COMPILED BY GREG KROLL

Dr. Brown Leaves *IJW* Editorial Board

Dr. Perry Brown has served on the *IJW* editorial board since 2003 and is stepping down due to added responsibilities as a result of his promotion to provost and vice president for academic affairs at The University of Montana–Missoula (UM). He has served UM since 2008 as associate provost for graduate education, and since 1994 as dean and professor, College of Forestry and Conservation, and director of the Montana Forest and Conservation Experiment Station. He has considerable expertise in natural resource social science, policy and planning, in recreation behavior and planning, and in wilderness studies. A lifelong resident of the western United States, he has served on the faculties of Utah State University, Colorado State University, and Oregon State University, in addition to his current assignment in Montana. We wish Dr. Brown well in his new assignment and thank him for his support of *IJW* and wilderness stewardship.

Greg Kroll Joins IJW Editorial Board

Over the last five years, Greg Kroll has served as the digest editor for *IJW*. Since 1999, Greg had worked under contract to the Washington office of the National Park Service (NPS) conducting, or helping to conduct, wilderness management and values training in more than 50 units of the NPS—all with either designated wilderness or Wilderness Study Areas—from the Arctic, to Hawaii, to the Everglades, to everywhere in between. From 1996 through 1999, Greg was the NPS representative at the Arthur Carhart National Wilderness Training Center in Missoula, Montana, where he coordinated wilderness training for all wilderness units of the National Park System. During 1985 to 1996, Greg served as a park ranger at Yellowstone National Park, first as public affairs officer, then as assistant chief naturalist. Greg has represented the NPS in Brazil, Costa Rica, Panama, Chile, Argentina, and Bolivia, where he taught ranger skills in Spanish to park professionals of those countries. Prior to his employment with the NPS, he worked for the California State Park System, the California Conservation Corps, and the Annette Island Indian Reservation in Metlakatla, Alaska.

Greg is a native of California and now a resident of Santa Fe, New Mexico. We welcome Greg Kroll to the *IJW* editorial board and thank him for his continued support of *IJW*, and especially his exemplary work compiling interesting information in the *IJW* Digest.

The Society for Wilderness Stewardship Launches Website

The new professional organization, Society for Wilderness Stewardship (SWS), has launched a comprehensive website at www.wildernessstewardship.org. The SWS is a national, not-for-profit, member-based society whose mission is "to advance the profession of wilderness stewardship, science, and education to ensure the life-sustaining benefits of wilderness." The SWS supports best wilderness management practices, the development of new stewardship frameworks, and seeks to ensure the long-term health and benefits of wilderness for the nation. Membership is open to wilderness managers, scientists, rangers, educators, resource specialists, wilderness stewards, and private individuals.

Submit announcements and short news articles to GREG KROLL, *IJW* Wildernss Digest editor. E-mail: wildernessamigo@yahoo.com

2010: A Very Successful Year for Italian Wilderness

Italian wilderness areas expanded on many fronts in 2010. The system now encompasses 65 distinct areas totaling 100,000 acres (40,000 ha). And according to Franco Zunino, general secretary of the Italian Wilderness Society (AIW), many other wilderness areas have been proposed. Additionally, AIW has established Wilderness Areas Guidelines for Italy and Europe, and a wilderness areas regional law will be presented to the Lazio Regional Parliament in the coming months.

- The Monte Camino Wilderness Area has been enlarged by 270 acres (110 ha) by the Galluccio Municipality (Caserta Province), bringing the total area to 2,350 acres (950 ha).
- The Fiume Tanàgro Wilderness Area has been enlarged by the Auletta Municipality (Salerno Province) to include 3 miles (5 km) of river, totaling 220 acres (90 ha).
- The Auletta Municipality has also designated a new Fiume Tanàgro Est Wilderness Area, of about 150 acres (60 ha) along 1.5 miles (2.5 km) of the river; and the Municipality of Petina (Salerno Province) has enlarged the Fiume Tanàgro Wilderness Area by 75 acres (30 ha) along its river bank, totaling 300 acres (120 ha), half inside a regional nature reserve.
- The Auletta Municipality has also designated four other wilderness areas: the Monti Alburni Wilderness Area (1,600 acres/650 ha) and the Serra Carpineto Wilderness Area (715 acres/290 ha)—both within Cilento-Vallo di Diano National Park; the Monte Forloso Wilderness Area (1,450 acres/580 ha); and the Vallone Sant'Onofrio Wilderness Area (1,000 acres/400 ha).
- A private agreement for the designation of a Fosso di Cucuruzzo Wilderness Area of 20 acres (8 ha) has been signed by a philanthropist in the Municipality of Galluccio (Caserta Province).
- The Bric Zionia Wilderness Area has been enlarged by the Murialdo Municipality to include 1.4 miles (2.3 km) of the Bormida River, bringing the total area to 235 acres (95 ha).
- The Le Mainarde Wilderness Area has been enlarged by the S. Biagio Saracinisco Municipality (Frosinone Province) by 3,700 acres (1,480 ha), half inside Abruzzo National Park and half outside of it. The total wilderness acreage is now 5,700 acres (2,310 ha).
- The AIW itself acquired 11 acres (4.5 ha) of forest to enlarge the Burrone di Lodisio Wilderness Area and the Langhe di Piana Crixia Wilderness Area.
- A philanthropist–founding member of the AIW has privately signed an agreement to protect as wilderness another 10 acres (4.2 ha) of forest, now included in the Burrone di Lodisio Wilderness Area, of 145 acres (59 ha), and the Langhe di Piana Crixia Wilderness Area, of 15 acres (6 ha).
- A Cima d'Arme Wilderness Area of 445 acres (180 ha) has been designated by Poggio Bustone Municipality (Rieti Province).

Obama Administration Revises Bush Wilderness Policy

In 2003, former interior secretary Gale Norton formalized an out-of-court settlement with former Utah governor Michael Levitt that stated that the U.S. Bureau of Land Management (BLM) could not establish new Wilderness Study Areas (WSAs) on its lands. The administration of President Barack Obama changed that Bush-era policy in December 2010. According to Secretary of the Interior Ken Salazar, "For the last seven years, the BLM—which manages more land than any other federal agency—has not had a comprehensive wilderness policy." Salazar said land managed by the BLM not already known to have wilderness characteristics will now be inventoried to determine if those characteristics are present. Whereas Secretary Norton said inventories could take place, Secretary Salazar has directed that they will take place. It is not known how many acres will be inventoried, but the BLM believes several tens of millions of acres will not qualify. Currently, slightly more than 20 million acres (8 million ha) of BLM lands are within WSAs or have been designated as wilderness by Congress. In total, the agency manages 245 million acres (99 million ha) of public lands, primarily in 11 western states.

Under the new policy, BLM director Bob Abbey is responsible for identifying lands with wilderness characteristics and subjecting those lands to a land-use planning process, with public input. Lands with wilderness characteristics may be preserved in areas to be called "Wild Lands," which will not be managed under the BLM policy used to manage WSAs. "Wild Lands" protections will be determined individually by each Resource Management Plan (RMP), while allowing for all multiple uses consistent with preserving wilderness characteristics for the life of that RMP. Even energy leases may be allowed if the development will not impair wilderness characteristics (such as diagonal drilling, with no surface occupancy, with well heads restricted to outside the protected areas). When the RMP is revised, the "Wild Lands" protections can be renewed, modified, or removed.

Until such time as "Wild Lands" have been indentified in an RMP, any proposed action that would impair a parcel's wilderness characteristics will require the approval of BLM managers. It is still Congress's exclusive prerogative to designate wilderness areas under the Wilderness Act.

The Congressional Western Caucus, an all-Republican group, blasted the policy change. Utah representative Rob Bishop said in a statement: "This is little more than an early Christmas present to the far left extremists who oppose the multiple use of our nation's public lands." Utah Republican senator Orrin Hatch also denounced the policy shift, stating that "it is time for this administration to put the needs of Utahans and other Americans above those of a few radical special interest groups who want to make the nation's public land their own personal playgrounds." (Sources: Reuters, December 23, 2010; Associated Press, December 23, 2010; Carhart National Wilderness Training Center)

Recent Study Examines Protected Areas' Value to Rare Species

Although protected areas are generally seen as a triumph for the preservation of nature, a recent study has found on-the-ground reality to be more complex. The world's largest protected areas encompass vast amounts of wilderness, but do not extensively overlap the highest-priority areas for conservation, or include unusually large numbers of birds, amphibians, or mammals, according to an analysis published in the November 2010 issue of *BioScience*. The study, by Lisette Cantú-Salazar and Kevin J. Gaston of the University of Sheffield, UK, nonetheless finds anecdotal evidence that some very large protected areas play an important conservation role by preserving natural species and populations of regional concern.

Cantú-Salazar and Gaston examined in detail the 63 protected areas that encompass 6 million acres (2.5 million ha) or more, located in all continents except Antarctica. The authors found that such areas are established where they will least inconvenience people, rather than where they would most benefit conservation. Very large protected areas are likely to include particular land-cover types, such as snow and ice, bare areas, and areas with sparse vegetation.

The study did find that several ecoregions of high conservation priority are located in very large protected areas, including the Guianan Highlands Moist Forests, the Tibetan Plateau Steppe, and the Eastern Himalayan Alpine Meadows. Cantú-Salazar and Gaston also conclude that many of the largest protected areas are vulnerable. Some have inadequate management, while others are threatened by incursions from logging, fishing, grazing, and mining, as well as the effects of climate change and political instability. (Source: *BioScience*, vol. 60, no. 10)

Reports Address Border Protection Issues on Federal Wildlands

Three recent studies have analyzed the complexities of enforcing international border security by the U.S. Border Patrol (USBP), a branch of the U.S. Department of Homeland Security (DHS), while operating in federal wildlands, including large tracts of designated wilderness managed by the Department of the Interior (DOI) and Department of Agriculture (USDA). Some media reports, as well as concerns expressed by some members of Congress, have claimed that rules in place to protect designated wilderness areas are impeding and endangering USBP agents who are attempting to carry out their responsibilities.

Southwest Border: More Timely Border Patrol Access and Training Could Improve Security Operations and Natural Resource Protection on Federal Lands, was published by the U.S. Government Accountability Office (GAO) in October 2010. The report concluded that federal rules governing public lands cause some delays, but do not prevent the USBP from fulfilling its mandate to secure the border. As part of its 11-month evaluation, the GAO interviewed agents-in-charge at 26 Border Patrol stations with primary responsibility for patrolling federal land along the U.S.-Mexico border.

Patrol agents-in-charge for 17 of 26 stations said that access to portions of some federal lands along the border has been limited because of land management laws, resulting in delays and restrictions in agents' patrolling and monitoring capabilities. Fourteen of the 17 stations reported that they have been unable to obtain permission to access certain areas in a timely manner because of how long it takes for land managers to conduct required environmental and historic property assessments. For example, USBP requested permission to move surveillance equipment, but by the time the land manager conducted an historic property assessment and granted permission—more than four months after the initial request—illegal traffic had shifted to other areas.

Nevertheless, 22 of the 26 agents-in-charge reported that overall, security status of their jurisdiction is not affected by land management agencies. Instead, factors such as the remoteness and ruggedness of the terrain have the greatest effect on their ability to achieve operational control. The report also found that of the four USBP agents-in-charge who said the laws affect their ability to

secure the border, two have not formally asked for better access, and two others had their requests denied by USBP senior officials who said there were more important needs. (Source: gao.gov/new.items/d1138.pdf)

Interagency Cooperation on U.S.-Mexico Border Wilderness Issues, published in September 2010, was authored by Kirk Emerson, Ph.D., environmental mediator and research associate at the University of Arizona's School of Government and Public Policy. The report documents interagency cooperation on the U.S.-Mexico border to improve both border security and the protection of adjacent wilderness areas. According to the report, "After a slow start and much trial and error, cooperation among federal departments and agencies... has been improving in the past few years. Departmental leadership has issued several policy directives and put in place organizational mechanisms that have created a framework for collaboration and conflict resolution among the departments and their respective agencies on the ground."

Based on research conducted during the summer of 2010, including more than 50 interviews with border security professionals, land management agents, and border area stakeholders, the report finds that interagency cooperation is occurring in five contexts: interagency communications, enhanced joint capacity, assistance to border security by land management agencies, assistance to land management agencies for mitigation and restoration, and joint efforts to protect public health and safety. Six case studies are included in the report to illustrate interagency collaboration. (Source: kirk_emerson.home.mindspring.com/Interagency_Border_Cooperation.pdf)

Border Security: Additional Actions Needed to Better Ensure a Coordinated Federal Response to Illegal Activity on Federal Lands was published by the GAO in November 2010. This is a public version of a report that GAO issued in October 2010, with sensitive information redacted at the request of the DHS. The report found that illegal cross-border activity remains a significant threat to federal lands, and that land managers would like additional guidance to determine when such activity poses a sufficient public safety risk for them to restrict or close access to those lands.

The report states that information sharing and communication among the DHS, DOI, and USDA have increased in recent years, but critical gaps remain in implementing interagency agreements. Agencies have established forums and liaisons to exchange information; however, in the Tucson, Arizona, sector, for example, agencies did not coordinate to ensure that federal land law enforcement officials maintained access to threat information and compatible secure radio communications for daily operations. The report also finds that there has been little interagency coordination to share intelligence assessments of border security threats to federal lands and to develop budget requests, strategies, and joint operations to address these threats. Several recommendations are included in the report. (Source: gao.gov/products/GAO-11-177)

Indigenous Djok People Support Enlarging Kakadu National Park

In what the International Union for the Conservation of Nature (IUCN) has called "a gesture of significant generosity and vision," Australia's Djok people have supported the incorporation of their traditional Koongarra lands into Kakadu National Park. As co-managers of the park, the Djok have stated their opposition to mining of the substantial uranium deposits on their lands, which are surrounded by the park and which contain wetlands of international significance. Koongarra lies in the shadow of Nourlangie Rock, one of Kakadu's most popular visitor destinations due to its ancient rock art galleries, first settlement paintings, and sacred burial sites. The decision permanently prohibits any future mining activity in the area.

Covering nearly 5 million acres (2 million ha) of exceptional natural beauty, and providing significant cultural values and unique biodiversity in the Northern Territory of Australia, Kakadu is an iconic World Heritage Site. It is one of the very few places listed for both its cultural and natural values. It contains the vast monsoonal wetlands of the Alligator Rivers and parts of the Arnhem Land escarpment where spectacular galleries of aboriginal art are located. (Source: iucn.org/knowledge/news/?5860/protected-forever)

Serengeti Faces Dual Threats

Tanzania's Serengeti National Park, a UNESCO World Heritage Site, is being threatened by a proposed highway as well as a recently arrived noxious weed.

The Tanzanian government is slated to begin building a 33-mile (53-km) two-lane road through the northern end of the park in 2012. The road would cross the path used by 2 million wildebeests, zebras, gazelles, and other grazers as they travel north in search of food and water during the dry season, with lions and hyenas in pursuit. It is called the Great Migration, one of the most spectacular assemblies of animal life on the planet. An opinion piece published in the journal *Nature*, signed by 27 researchers from around the world, warns that "the road will cause an environmental disaster by curtailing the migration.…Migratory

species are likely to decline precipitously, causing the Serengeti ecosystem to collapse." Scientists say collisions between animals, vehicles, and humans can be expected, likely leading officials to build fences, as was done in Canada's Banff National Park to prevent collisions with wildlife. But according to University of British Columbia zoologist Anthony Sinclair, wildebeests don't know how to deal with fences. "They run straight into them," Sinclair said. "They pile up against the fence and… they just push further forward until the whole lot of them get crushed."

In an attempt to protect the park from the highway project, chief executive officers of the International Union for Conservation of Nature (IUCN), the World Commission on Protected Areas, and the World Wide Fund for Nature (WWF) formally appealed to Tanzanian president Jakaya Kikwete to reexamine the proposal. The request was immediately endorsed by UNESCO. The World Bank looked into financing such a highway 20 years ago and rejected it, partly for environmental reasons. WWF International has proposed three alternative roads, pledging to offer technical assistance to the government for development of the routes.

Hundreds of thousands of Tanzanians depend on tourism for a living. The Serengeti attracts more than 100,000 visitors each year, producing millions of dollars in park fees and helping drive Tanzania's billion-dollar safari business. "If anything bad happens to the Serengeti," said Charles Ngereza, a Tanzanian tour operator, "we're finished."

Meanwhile, Kenya's Masai-Mara National Reserve, which is effectively the northern continuation of Serengeti National Park, is under attack from a noxious weed from Central America, commonly known as feverfew (*Parthenium hysterophorus*.) Parthenium has gained notoriety in Australia, India, and Ethiopia where it was accidentally introduced with disastrous consequences. The weed, which can grow from seed to maturity in four to six weeks and has an ability to produce 10,000 to 25,000 seeds, is allelopathic (it produces chemicals that inhibit the growth of other plants.) If it invades natural pasture, it can reduce available forage by up to 90%. It is also toxic; animals will not eat it unless they are starving or stressed, with fatal consequences. Parthenium has been found growing along parts of the Mara River and along some dirt tracks in the Masai-Mara National Reserve.

The plant's implications for wildlife conservation in the Serengeti ecosystem are extremely serious. The movement of millions of grazing animals leaves the native grasslands highly disturbed, making it easy for parthenium to invade. "Unless action is taken immediately to eradicate known infestations in the Masai-Mara National Reserve, it is not unrealistic to expect a drastic reduction in wildlife populations," says Geoffrey Howard, IUCNs Global Invasive Species Programme coordinator. "It is therefore possible for a little green plant to transform one of the greatest spectacles on earth." (Sources: CBC News, September 17, 2010; *The New York Times*, October 30, 2010; *The Citizen* [Tanzania], December 12, 2010; iucn.org/knowledge/news/?6511/Noxious-weed-threatens-the-biggest-wildlife-migration-on-the-planet)

Book Reviews

Nature's Spectacle: The World's First National Parks and Protected Places

By John Sheail. 2010. Earthscan. 360 pages. $99.95 (hardcover).

The year 1967 was a watershed in the subject of conservation history. Clarence Glacken's *Traces on the Rhodian Shore* provided a seminal environmental history, and Roderick Nash's *Wilderness and the American Mind* was the first major work to review a national history of protected areas and wilderness. These works, and the many others that followed them, have provided significant advances in our knowledge of the sociocultural roles of parks and wilderness areas.

Nature's Spectacle seems to differ in several ways from these "normal" historical analyses. First, whereas authors' nationality is normally tied to the region or nation they write about (e.g., Roderick Nash and American parks), the author of this work is British, yet he reviews the history of several nations' park systems. Indeed, this book reviews the history of national parks and other protected areas from a much larger range of nations than usual: protected areas in the United States, Canada, Australia, and New Zealand, and, to a lesser extent, various European, Asian, and African countries are all discussed. Second, Sheail does not review each protected area system separately, but reviews the shared commonalities in creating national parks and other

protected areas from a changing variety of nations from 1850 to 1950.

Sheail suggests that the first national parks "are seen not as something exceptional, but rather as bound closely up, in their variety of function and form, with the wider aspirations and preoccupations of those who established and managed them" (p. 2). Although this is not a novel approach, Sheail also suggests that the book will focus on why the national park moniker became the most popular of all protected areas around the world. Unfortunately, this fascinating question is never really fleshed out as much as it could be, although the author concludes in the final chapter that "for many, it is the scale of national parks, both in their extent and apparent permanence of feature, which makes them so memorable as natural spectacles—images to be personally treasured and culturally boasted of" (p. 297).

Like many authors before him, Sheail identifies a range of social and cultural issues that lie at the heart of the growth of the national park ideal: romanticism and transcendentalism, urbanization, national pride, tourism, and the growing awareness that humans were destroying forests and wildlife. Rather than focusing on providing a depth of information on each national park system through the use of primary sources—as most traditional park histories have done—Sheail reviews secondary literature to provide a wider breadth of information on the reasons behind the rise of national park systems in many nations around the world. Indeed, this almost global breadth of information in *Nature's Spectacle* is its greatest strength and provides the most significant addition to the park history literature.

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Beyond Naturalness: Rethinking Park and Wilderness Stewardship in an Era of Rapid Change

Edited by David Cole and Laurie Yung. 2010. Island Press. 368 pages. $35.00 (paperback)

Most of us are creatures of habit. We tend to deal with change by using "tried and true" strategies, and look at the world using well-established, hegemonic viewpoints. Similarly, conservation managers have tended to follow predictable patterns in how they conceive of nature and conservation, and normally use similar managerial approaches and methods in managing protected areas. The editors and authors of *Beyond Naturalness* warn that continuing to follow this well-worn path of protected area management will be detrimental to the protection of biodiversity and healthy ecosystems in parks and wilderness.

Cole and Yung suggest that the rapid changes to societal and natural systems evident in the 21st century—including climate change, invasive species, global pollution, and fragmentation—together with the impact of new conceptualizations of nature (via landscape ecology, complexity theory, and constructivism) require us to rethink how we manage protected areas. Most importantly, "As myths about natural systems have been deflated, the value of naturalness as a conceptual foundation on which to base operational management decisions has been called into question" (p. 25). Basically, research in landscape ecology and conservation biology has shown that a "natural" landscape does not exist: unpredictable change based on disturbance creates uncertainty and suggests there is no one "natural" state of any ecosystem.

Beyond Naturalness suggests that "the key challenge to park and wilderness stewardship is to decide where, when, and how to intervene in physical and biological processes to conserve what we value in those places" (p. 7). Only one chapter advocates a "hands-off approach" to wilderness management; the rest of the authors debate how, when, and why human intervention should be used to respond to these new challenges. Potential conceptual foundations include the use of the concepts of ecosystem integrity, historical fidelity, and resilience.

The final section of the book identifies a diverse range of managerial approaches and techniques, noting that "to effectively deal with rapid change, uncertainty, and surprise, planning must be more adaptive—more dynamic, flexible and responsive" (p. 161). The need to provide additional clarity in articulating the purpose of each protected area and desired outcomes of any interventions are particularly highlighted.

Beyond Naturalness is an outstanding, significant addition to the conservation literature. It is required reading for all park and wilderness researchers, administrators, and managers, as it analyzes the "old" and "new" ways of thinking about conservation, identifies the current challenges to park management, and suggests a range of new managerial approaches and techniques needed to deal with the myriad contemporary social and natural changes affecting conservation. This is a wonderfully balanced and erudite exploration of the need for new approaches in the often hidebound realm of park and wilderness management.

Reviewed by JOHN SHULTIS, faculty member at the University of Northern BC, Prince George, BC, Canada, and *IJW* book editor; email: shultis@unbc.ca.

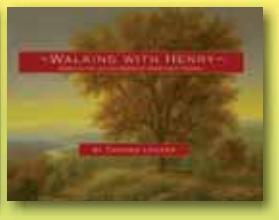
For the young conservationists in your family

John Muir • Rachael Carson • Henry David Thoreau

Hudson
The Story of a River
Thomas Locker and
Robert C. Baron

Rachel Carson
Preserving a Sense of Wonder
Thomas Locker and
Joseph Bruchac

John Muir
America's Naturalist
Thomas Locker



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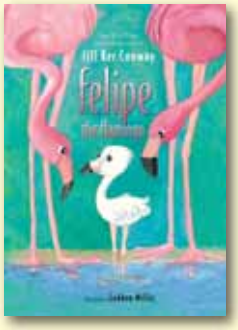

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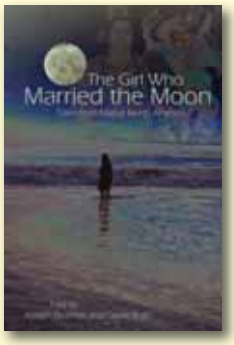

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